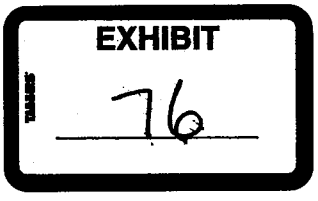
COMPREHENSIVE MANAGEMENT PLAN

FOR

NONPOINT SOURCE POLLUTION

ILLINOIS RIVER BASIN
IN
ARKANSAS

ARKANSAS SOIL & WATER
CONSERVATION COMMISSION
1996



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INTRODUCTION

Comprehensive Management Plan
For Nonpoint Source Pollution Illinois River Basin
In Arkansas

Introduction

This document is intended to be a comprehensive plan for the control of nonpoint source pollution within the Illinois River Basin in Arkansas. It is intended to be a practical and workable solution to the problems of nonpoint pollution. We realize that to be a workable plan, all contributors to the problems must participate in the planning and the application. To be practical we must consider all aspects of, and impacts of the problems and proposed solutions. We also realize that planned solutions must be reasonable and within the ability of the people who will carry them out. With these thoughts in mind, the following tasks were completed. We have reviewed all available literature, both published and unpublished. Oklahoma's draft management plan , for their part of the Illinois River Basin, was reviewed. We have reviewed comments and suggestions from many experts from local, state, and federal agencies. Last but not least, discussions were held with individual land users.

This will be a voluntary plan; with assistance, both technical and financial, being provided through ongoing programs and future special programs that may arise as priorities develop within the area.

Goals

The Arkansas goal is simple; To reduce and control nonpoint source pollution in the Illinois River Basin to acceptable limits. Acceptable limits here are defined as that amount of pollutants that can be present while fully supporting designated uses of the stream and without adversely affecting the environment within the area or downstream.

The main receiver of pollutants in the basin is the Illinois River. While, it is understandable that the river has received more attention than other areas; it is the intent of this plan to address all the areas receiving nonpoint source pollution. These include both surface and ground waters.

Description of the Area

The Illinois River Basin in Arkansas is an area of approximately 493,536 acres. The basin is located in Washington and Benton counties (see Fig. 1). The three main streams entering Oklahoma from the Basin are the Illinois River, Flint Creek, and Barron Fork. Flint Creek and Barron Fork enter the Illinois River after they enter Oklahoma. About one third of the area (southern part) is within the Boston Mountain ecoregion and the northern two thirds is within the Ozark Highlands ecoregion. (see Fig. 2)

The Boston Mountain portion of the basin is characterized by steep slopes and deep valleys. The maximum elevation is about 1700 Ft. MSL, and the minimum is about 1200 Ft. MSL. Soils are typically thin and are derived mostly from sandstone and shale (see Fig.3).

The Ozark Highlands part of the basin is characterized by rolling hills and gently sloping floodplains. The soils in this area are generally deeper and more fertile than in the Boston Mountain area. These soils are derived mostly from chert and limestone. Elevations in this area range from about 1000 Ft. MSL to 1300 Ft. MSL.

Some of the soils in the basin are excessively drained and are shallow over fractured bedrock. When excessive nutrients are applied to these soils underground water pollution is apt to occur.

Many other soils in the basin are very slowly permeable or have an impervious layer which restricts infiltration and causes a perched water table at or near the surface. This in turn causes excessive runoff which carries pollutants with it. Both types of soils have severe limitations for septic tank filter fields because of their inability to filter out pollutants (soil surveys of Washington and Benton Counties USDA, NRCS and USFS in cooperation with Arkansas Agricultural Experiment Station).

The population of the basin is approximately 125,000 based on the 1986 census report plus about 2.3 percent annual increase. The average annual increase was taken from the average increase between 1980 and 1986. This was calculated using data given in Figure 11 of the Illinois River Cooperative River Basin Resource Base Report of 1991. This estimate is considered conservative.

The dominant industry in the basin is agriculture, with poultry and livestock being predominant. The average annual production of poultry and livestock is 170,000,000 broilers, 6,000,000 laying hens, 2,000,000 pullets, 600,000 breeders 700,000 turkeys, 118,000 beef cattle, and 60,000 head of swine. In addition there are approximately 8,000 dairy cattle in the area.

Other major industries include retailing (Wal-Mart), and trucking (J.B. Hunt). There are a variety of other smaller industries.

Land use in the area is given in Table no.1 by hydrologic unit, and illustrated in Figures 4 & 5.

References

- Arkansas Water Resources Research Center Report 1990.
- Illinois River Cooperative River Basin Resource Base Report 1991. USDA, NRCS & USFS.
- Keener, R., 1972, Septic tank contamination of ground water: Unpub. spec. problem, Civil Eng. Dept., University of Arkansas, Fayetteville, 23p.
- Peterson, Cheryl R. Alternatives to Septic System Home Wastewater Disposal in Northwest Arkansas, Report No.7.
- Soil Surveys of Washington and Benton Counties; USDA NRCS & USFS, in cooperative with Arkansas Agricultural Experiment Station.

ILLINOIS RIVER
LANDUSE
TABLE NO. 1

		LANDUSE IN ACRES					
Hydrologic Unit	**Total Acres**	**Forest**	**Pasture**	**Cropland**	**Orchards**	**Urban**	**Other**
4001	63,072	28,889	27,600	790	115	1,251	4,129
4002	50,000	18,517	16,605	280	1,500	8,472	4,626
4003	144,764	28,707	80,516	8,887	4,560	12,115	9,979
4004	46,713	15,521	25,040	1,060	449	828	3,805
4005	39,947	18,593	18,518	0	0	494	2,342
4006	46,021	8,790	30,869	0	291	3,199	2,872
4007	31,867	11,593	17,375	1,280	37	168	1,414
4008	71,126	36,200	27,615	1,120	260	1,121	4,810
TOTAL ACRES	**493,510**	**166,810**	**244,138**	**13,417**	**7,212**	**27,658**	**33,977**
%		34%	49%	3%	1%	6%	7%

Source of Data - Adapted from the Illinois River Cooperative River Basins Sudy Report.

PROBLEMS

Problems and Concerns:

A summary of the water quality problems in the Illinois River Basin is given in the 1994 Water Quality Inventory Report (305(b) report) prepared by the Arkansas Department of Pollution Control and Ecology. The Illinois River Basin has a total of 146 miles of stream within the basin according to the report. Degree of support of designated uses by streams in the basin is given in the Table No. 2.

Documentation	Table No. 2 Miles Supporting Designated Use 1992 Water Quality Inventory Report					
	Fish Consumption	Aquatic Life	Swimming	Secondary Contact	Drinking Water	Agri. & Ind. Water
Monitored	66.4	41.5	0	66.4	66.4	66.4
Evaluated	79.6	0	0	79.6	79.6	79.6
Total	146	41.5	0	146	146	146

Pathogens were listed in the report as the major cause of nonsupport of designated uses in 132.7 miles of stream. Silt caused the nonsupport in 13.3 miles of stream. In addition, nutrients were listed as a minor cause of impairment in 53.9 miles of stream. Pathogens were a minor cause in 2.5 miles, and silt was the minor cause in 81.6 miles.

Kratzer (1979) proposed that a concentration of 0.9 mg/l for total Nitrogen as N would be great enough to cause eutrophic conditions. At the seven stations reported in the 1992 305(b) report, the average nitrate plus nitrite concentration was 2.67 mg/l reported as N with a range of 1.86 mg/l in the Illinois River near Savoy, Arkansas to 5.69 mg/l in Sager Creek north of Siloam Springs. The average concentration for total phosphorus given in the seven reported stations was 0.30 mg/l with a range of 0.06 in Flint Creek to 0.97 in the Sager Creek. The guideline for phosphorus concentrations given in the Arkansas Department of Pollution Control and Ecology's Regulation No. 2, "Regulation Establishing Water Quality Standards for Surface Waters in the State of Arkansas" is that Phosphorus not exceed 0.1 mg/l in streams or 0.05 mg/l in lakes and reservoirs. The mean value on all but two of the sites reported in the 305(b) report exceeded this guideline.

Problems with groundwater in the Illinois River basin are not as widespread but are apparent. In a 1990 study conducted for the Arkansas Department of Pollution Control and Ecology by the University of Arkansas, three wells out of 78 sampled tested over 10 mg/l nitrates as N (the safe drinking water maximum) an additional five wells tested at between five and ten mg/l nitrates. From 1989 to 1991, the University of Arkansas Cooperative Extension Service

conducted a survey of 3,171 wells in twenty one counties in Arkansas including Benton and Washington counties. The Extension Service survey reported nitrates as NO_3 rather than the normal N. Forty four parts per million nitrates as NO_3 is the safe drinking water level, as established by the Health Department. Of the 1,073 wells sampled by the Extension Service in the two counties that contain the Illinois River basin (Benton and Washington), forty-seven or roughly four percent tested at forty-five ppm or higher. Steele also found that the average nitrate - N concentration in poultry production areas of Washington county was 2.83 mg/l compared to 0.25 mg/l for relatively pristine areas of the county.

Potential Problems:

A series of four focus group meetings were held in the Illinois River basin during the fall and winter of 1991/1992. These focus groups were made up of a cross section of people from the entire community and from different interest groups. Participants in these meetings expressed both water quality and socio-economic concerns about the river. The ASWCC has searched available data to determine if the perceptions of the focus groups can be documented with hard data. To simplify the report, these potential problems have been grouped into categories and are listed below:

Increased Flooding / Drought: Three participants expressed concern that floods in the basin may be more severe than in the past and that flows dropped lower during periods of drought. Conceivably, an increase in the acreage of impervious land cover could have a result similar to the concern expressed. James C. Petersen's report, "Trends in Stream Water-Quality Data in Arkansas During Several Time Periods Between 1975 and 1989", published by the U.S. Geological Survey in 1992 indicates that the Illinois River did have a statistically significant upward trend in flow over the period. Neither the magnitude of the increase nor the slope of the trend line were reported in the report. The data seem to indicate that the concern is valid although management of streamflow is beyond the scope of this plan.

Loss of Clarity: One focus group participant expressed a concern over loss of clarity of water in the river. Two other participants noted water changing from "clear to green". The cooperative report on "Evaluation and Assessment of Factors Affecting Water Quality of the Illinois River in Arkansas and Oklahoma" by the University of Arkansas and Oklahoma State University (1991) indicates that the data on relative clarity of the water do not indicate any general trend of decreasing clearness. Petersen's report seems to substantiate this assessment. In Petersen's report one downward trend in turbidity was noted in streams in the basin and one upward trend was noted.

The relative "greenness" of water is not normally reported in studies. Green color in a stream could result from an increase in alga or phytoplankton production. Alga and phytoplankton production in turn could result from increased nutrient loading, increased temperature, increased sunlight or other factors. From the available data, it is impossible to determine if this potential problem is documented. Conditions exist that could result in a green color to the stream.

Foam: One focus group participant expressed concern over foam on the streams in the basin. The available data do not document whether or not foam is a problem in the Illinois River. Foam is common on Ozark streams and lakes. It can be the result of either natural or cultural inputs to the stream.

Fish and Wildlife: Four focus group participants expressed concern over a general degradation of the fishing in the basin. This concern included a drop in weight of the fish, infection of fish and degradation of habitat.

In addition to the expressed concerns over water quality, a number of issues were raised relevant to the condition of the water but not directly reflected in a water quality problem.

Agriculture: The only concern by the focus groups listed under this heading is animal waste runoff. Three focus groups listed this as a concern. From Arkansas Agriculture Statistics 1989 we can compute that a total of 6,556 Tons of nitrogen, and 2,372 Tons of phosphorus per year are produced in animal waste within the Illinois River Basin in Arkansas. The Science and Education Administration's Agricultural Research Staff reported in its manual titled Animal Waste Utilization on Cropland and Pasture that total dissolved nitrogen and phosphorus transported in annual runoff from pasture land receiving poultry manure applications at agronomic rates is about 15.2 and 3.8 lbs./acre/year respectively. By using these figures for estimates it is apparent that animal waste runoff is a potential problem. This data is presented in Table #3.

Corridor: Two focus groups expressed a concern about degradation of riparian zones and one group was concerned about erosion of streambanks caused by animals. It is apparent from observation and photographs that cattle could be a potential source of damage to the riparian areas along the streams. It is estimated that 11,750 head of cattle have access to the streams within the area. Whether or not this trend is getting worse has not been documented. Streambank erosion was measured on a 22 mile segment of the Illinois River during a recent survey (Summer 1994). Future trends can be observed by comparing these figures with future survey figures.

Urban: All four focus groups listed urban runoff as a concern. Table 1 shows 27,658 acres in urban and build up areas. If we use Urbanization and Water Quality: A Guide to Protecting the Urban Environment, as a guide, it becomes apparent that runoff from urban areas within the basin is a major contributor to degradation of water quality within the area. It is even more important when we consider the fact that the area population is growing at a rate of three percent per year. Group four expressed a concern that septic tanks pose a problem. Groundwater contamination is expressed as a problem in the previous discussion. Cheryl R. Peterson in her report Alternatives To Septic Tank Home Wastewater Disposal in Northwest Arkansas concluded that: (1) in Northwest Arkansas the Boone Aquifer is generally an unconfined aquifer which is extensively tapped for domestic water supplies; and (2) the aquifer is being contaminated by septic tank effluent.

Political/Government: The general feeling of the groups is that there is a general confusion and misunderstanding about problems, and that there are inconsistent and conflicting laws and standards that govern the use and/or misuse of the waters of the Illinois River Basin; as well as a general lack of planning.

Recreation: The groups here expressed a concern that there is a general loss of quality for human use in the river. They also expressed the concern that access to the river is limited. There also seems to be a fear that future development in the basin may not be compatible with recreational use of the river, and that there is a need for more monitoring of the recreation impact on the river.

REFERENCES

1. EPA 600/2-79-059, Animal Waste Utilization on Cropland and Pastureland. Table 18

2. Scott, et. Al. The Impact of Land Application of Poultry Litter and Swine Manure on Ground and Surface Water Quality in Western Arkansas, U of A Dept. Of Agronony, 1992 pp 87.

3. Kelly Gage, U of A Cooperative Extension Service, personal communication, 6-23-94.

4. Clary, Warren P. And Webster, Bert F. "Managing Grazing of Riparian Areas in the Intermountain Region"

5. Arkansas Department of Pollution Control and Ecology, Water Quality Inventory Report, 1992.

6. Terrene Institute, Urbanizaion and Water Quality, March, 1994, pp1.

7. U.S. EPA, "Rural Roads: Pollution Prevention and Control Measures," September 1992

8. U.S. Geological Survey, Water Resources Investigations Report 88-4112, Table 70.

SOURCES

Potential Sources of Pollutants

Based on the preceding discussion, stream impacts can be placed into four broad classes; bacterial contamination, nutrient enrichment, sedimentation and habitat degradation. Each of these classes are effected by many different categories of pollution. In this section, the categories that have been documented to be impacting and those that clearly have potential for impacting the waters of the basin are identified and discussed.

Agriculture:

Arkansas' Nonpoint Source Pollution Assessment report lists agriculture, specifically confined animal management, as the most probable source of pollutants causing impairment of 138 miles of stream in the Illinois River basin. The basin possibly has the most intense livestock production of any area in the state. Annual production of poultry and swine is close to 180 million birds and 100,000 head respectively. In addition, there are just over 8,000 dairy cattle in the watershed and around 120,000 head of beef cattle are raised each year, Table 3. These animals produce an estimated 280,000 tons of manure and litter annually. Clearly, livestock production has the potential to impact the waters of the basin if these materials are mismanaged.

Table 3
Annual Production of Livestock in the Illinois River Basin

Laying Hens	6,022,393
Broilers & Cornish	170,332,476
Pullets	1,813,691
Breeders	643,767
Turkeys	700,760
Swine	91,432
Dairy Cattle	8228
Unconfined Cattle	117,724

(Arkansas Agricultural Statistics, 1989, NRCS Inventory, 1990)

Poultry and swine are grown primarily in confined facilities in the basin. Beef cattle are generally raised unconfined on pasture. Dairy is confined for a part of the day during the milking period and pastured the remainder of the time. Litter and manure from confined facilities are most often land applied to pasture as a fertilizer and soil amendment, making cattle production profitable. Other methods of disposal include feeding to cattle and composting for

sale as a commercial product. Dr. Edwards et.al. at the University of Arkansas have shown that runoff from plots receiving litter or manure can have a potential impact on water quality of the streams.

Runoff water from areas where manure is improperly managed can carry excessive amounts of nutrients, bacteria, and sediments. These pollutants can enter streams and leach into the underground water. Estimated total nitrogen and phosphorus concentration in runoff from land receiving livestock or poultry manure surface applied at agronomic rates is 11.9 ppm N and 3.0 ppm P_1. In addition, an indeterminate amount of N from these farms is leached into the groundwater, and some is washed out of litter storage areas.

The impact of unconfined cattle on water quality has not been as thoroughly researched in Arkansas as that of confined animal manure management. According to the U of A Extension Service, only about five percent (5%) of the ration fed to cattle in Northwest Arkansas is from off farm sources$_3$. Therefore, it may be safe to assume that pastured cattle do not contribute heavily to the nutrient mass balance of the watershed. However, when cattle have access to streams they may have an impact. Direct deposit of nutrients and bacteria are one obvious form of impact. Most of the research on the impact of cattle on streams has been conducted in the western part of the U.S. This research is not entirely applicable to the Illinois River basin because of the more temperate climate. Potential impacts would be similar, although the magnitude might be somewhat less. Potential adverse impacts of grazing in riparian zones include; higher stream temperatures from lack of sufficient woody streamside cover, excessive sedimentation in the channel from bank and upland erosion, channel widening from hoof caused bank sloughing and later erosion by water, change in the form of the water column and the stream channel, change, reduction or elimination of vegetation, elimination of riparian areas by channel degradation and lowering of the water table, gradual stream channel trenching or braiding$_4$.

Erosion from cropland and pastures also contributes to water quality degradation, not only by adding nutrients, but also with sediment. Erosion from other areas on farms, woodland, roads, and streambanks is discussed under those headings.

Based on the data given above, the ASWCC has estimated that the total N and P loading in runoff from livestock farms is 1,080 tons and 251 tons per year respectively, Table 4..

Urban Runoff:

Urban runoff carries pollutants from many sources and activities including automobiles, oil and salt on roads, atmospheric deposition, processing and salvage facilities, chemical spills, pet wastes, industrial plants, and disposal of chemicals used in homes and offices$_6$. Six percent of the Illinois River basin is urban area. The urban area is mostly in the eastern most portion of the basin including the cities of Rogers, Springdale and Fayetteville. Urban NPS pollution is identified as a source of impairment in 13.5 miles of stream in the basin$_5$. Since the population of the area is growing at an annual rate of three percent, urban NPS can be expected to become more significant in the future unless management measures are implemented.

Phosphorus concentration in typical urban runoff is from 0.26 ppm for residential areas to 1.08 ppm for more heavily developed areas; nitrogen varies from 2.00 ppm up to 13.6 ppm. Urban runoff also carries heavy loads of sediment and bacteria as well as oil and grease and small amounts of heavy metals. Based on these concentrations and a runoff coefficient of 0.8 for urban areas and 0.45 for suburban (residential) areas an estimated 690 tons nitrogen and 60 tons phosphorus are exported from the urban areas each year. Table 4.

Construction:

Construction is a significant source of sediment because of extended periods which bare soil is exposed to rainfall and runoff. Erosion from construction sites can be as much as 100 times greater per acre than those from agricultural lands. Based on the 208 plan for the basin, extrapolated for 1994 conditions, we have estimated that there are over 2,000 acres of construction in the watershed each year. Roughly 40 of these acres would have severe erosion, 750 moderate erosion and the remainder light erosion. This calculates to be 28,879 tons per year as reflected in Table 4. These volumes of sediment likely are causing local impacts to the streams in terms of turbidity, sedimentation and loss of habitat. Construction activity is not likely to be a significant contributor to nutrient loading of the Illinois River.

Roads:

There are over 2,000 miles of roads in the Illinois River basin. Responsibility for maintenance of these roads may lie with private individuals, the county, municipalities or the state. Pollutants can be delivered to streams and lakes from both paved and unpaved roads. Runoff from paved roads has been shown to contain sediments, nutrients, oil, grease, metals and salts. Erosion of road surfaces during rainfall event may result in sedimentation of streams or lakes if the runoff is directed into a water body. These sediments then can result in increased turbidity and embeddedness of the gravel on stream beds and loss of spawning areas for game fish. Sediment will also carry attached nutrients, primarily phosphorus.

Arkansas' Nonpoint Source Pollution Assessment summary prepared pursuant to section 208 of the Clean Water Act (the 208 plan) gives an average annual soil loss for all roads in the basin as 82.9 tons per mile. The 208 plan also gives the total annual roadsurface and roadbank erosion for planning segment 3J (Illinois and Grand River basins) as 254,047 tons. Excluding the portions of segment 3J that are not in the Illinois River basin, the estimated annual erosion rate from roads is about 170,000 tons. This represents about fourteen percent of total erosion in the basin. Using average soil test nitrogen and phosphorus values from the U of A Extension Service for the basin, the total nitrogen and phosphorus content of this erosion would be roughly 2 tons per year and 24 tons per year respectively. There are no current estimates for the other potential pollutants from roads.

Streambanks:

Streambanks are a potential source of sediment and nutrients if excessive erosion is allowed to occur. The definition of a stream for this plan is: Any watercourse that has a defined channel and enduring pools. Other watercourses will be considered as a part of the landuse they are within, (pasture, woodland, etc.). Some streambank erosion occurs naturally in the Illinois River and it's tributaries as it does in any river system. This is not considered a problem. Accelerated or excessive erosion is however, a concern. A recent survey by the ASWCC of a 22 mile section of the Illinois River shows 13,094 ft. of banks with excessive erosion. Many different factors will contribute to excessive erosion; removal of the natural vegetation (trees) from the streambank; disturbance of the riparian area by livestock, people, vehicles, etc.; gravel removal from the streambed; excessive runoff water caused by upstream development, and other factors.

The 208 plan indicates that streambanks in the basin are eroding at about 47,000 tons per year. Based on the average soil test nitrogen and phosphorus values, this calculates to be 0.5 and 6.26 tons / year nitrogen and phosphorus respectively. The sediment loading could create some damage to the river, especially on a local basis.

Mining:

The 1977 RIDS data shows a very small amount of erosion from mining operations. Although the amount of nutrient pollution to the river from mining operations is small (Table 3), the disturbance to streams from gravel removal from the streambeds may be a problem.

A study by the Arkansas Cooperative Fish and Wildlife Research Unit University of Arkansas titled Impacts of Gravel Mining on Fish Communities In Three Ozark Streams, was summarized as follows:

> The results indicated that gravel mining degrades the quality of Ozark stream ecosystems and reduces the number of most types of fish. Stream channel form was altered, sedimentation rates and turbidity increased, downstream pools became shallower, and downstream riffles reduced in area due to mining. These changes resulted in extensive, shallow flats that favored nongame fish capable of tolerating occasional higher turbidity and siltation levels.
>
> Gravel mining breaches the streams stability by removing large portions of gravel substrate, bed armoring substrates such as boulders and large cobbles, woody debris, and macrophyte beds. Mining also destabilized riverbanks by creating flow upheavals, loaded the flow with turbidity and caused loss of riparian zones. These alterations of the physical habitats resulted in smaller invertebrates and smaller fish at disturbed and downstream sites.
>
> Alteration of physical habitat significantly influences the biotic communities of Ozark streams. Decreases in numbers of fish, game/nongame fish ratios, gamefish biomass, and loss of species occurred in the disturbed sections of the rivers.

Onsite Wastewater Disposal:

Other than municipalities, the dominate form of domestic wastewater disposal is the septic tank, leach field system. House counts from county highway maps indicate approximately 42,000 persons are utilizing septic tanks for disposal of wastewater. If properly installed, septic tanks should contribute relatively little to pollution of the streams in the basin. However, leaching of nitrates into groundwater is a concern. If the nitrate in the wastewater is not taken up by plants in the leach field, then the remainder will likely leach into the shallow groundwater system. The ASWCC estimates that about 139 tons of nitrogen per year, from septic tanks, are leached into the groundwater. This was calculated by using an average of 350 gal. per day from 12,000 septic tanks; an average of 40 mg/l of Nitrogen in the waste water; an average size of 24' X 100' for filter fields; and an average of 300 lbs. Per acre per year of uptake of Nitrogen by vegetation. Malfunctioning septic tanks may also be a local source of bacterial contamination.

Silviculture:

Potential pollutants from silviculture are sediment and nutrients carried in erosion. Harvesting and other management activities may impact the riparian zones along streams. Table 1 shows that there are 166,810 acres of woodland in the Illinois River basin in Arkansas. About 30,000 acres of this is in the Ozark/St. Francis National Forest and the remaining private woodlands. The contribution of sediments and nutrients from woodlands in the basin is relatively small compared to other sources.

Point Sources:

The Arkansas Department of Pollution Control and Ecology lists the cities of Fayetteville, Gentry, Lincoln, Prairie Grove, Rogers, Siloam Springs and Springdale as the major point sources in the Illinois River. The total annual loading from these sources is computed from monitoring data at the treatment plants. Total annual nitrogen and phosphorus from these sources is listed in Table 4.

Background Loading:

If all of the cultural sources of pollution were removed from the river basin, there would still be small amounts of sediments, nutrients, bacteria, minerals etc. in the river system. These elements are the result of the natural contribution from the native flora and fauna and stream hydrogeology. To make an estimate of natural loading, we first selected the Buffalo River as the most pristine river of similar size in the Ozark Highlands ecoregion. The average concentration of nitrate plus nitrite nitrogen in the Buffalo at St. Joe is 0.13 ppm and total phosphorus is 0.06 ppm. Using these concentrations and the average flow in the Illinois of 785 cfs, the annual loading from background sources is estimated to be 100 tons nitrogen and 46 tons phosphorus. Barron Fork and Flint Creek also contribute to the total load of nutrients exported from Arkansas. Assuming that those two streams have similar concentrations as the main stem, then the total flux of these two elements across the state line from background sources is 130 tons per year nitrogen and 60 tons per year phosphorus, (table 4).

A survey of a section of the Illinois River (about 22 miles) in the fall of 1994, indicates that sediment is a major factor in the degradation of water quality in the river.

Table 4 shows the potential amounts of sediment from each of the sources. These figures were calculated using information from the Arkansas' Nonpoint Source Pollution Assessment Summary, and the Terrene Institute, Urbanization and Water Quality, March 1994. If potential amounts only are considered, agriculture land would be the big contributor. If however, transport ratios as described in Water Quality, prevention, identification, and management of diffuse pollution by Vladimir Navotny, Milwaukee, Wisconsin, and Harvey Olem, Herndon, Virginia, are used the contribution from roads becomes the larger figure, Table 5 , last column. These are the figures which are the most important since they are the amounts of sediment which will probably enter the streams.

Groundwater:

The hydrogeology of the Illinois River system is not entirely understood. However, it is likely safe to say that the base flow in the river is the result of the surface/groundwater interface. That is to say that the base flow is the contribution of groundwater to the stream from springs, seeps and direct recharge. Groundwater in the basin has elevated levels of nitrate nitrogen when compared to similar pristine areas (2.83 mg/l vs. 0.25 mg/l)$_1$. This indicates a cultural contribution of nitrate to groundwater from activities in the basin. Some of this nitrate is from septic tanks and the remainder from unidentified sources. Likely sources are leaching from manure application areas, leaching from suburban lawns and groundwater recharge from runoff containing high levels of nitrate.

To compute groundwater contribution to the total load of nitrate in the system, the 25th percentile flow was taken as representing baseflow (97 cfs)$_8$. The difference between 2.83 mg/l and 0.25 mg/l was taken as the cultural load. From the total load computed, the estimated contribution from septic tanks was deducted since it has already been reported. The result is 190 tons per year.

Table 4
Potential Annual Loading of Nutrients by Category

CATEGORY	ANNUAL LOSS OF NUTRIENTS TO RUNOFF IN TONS / YEAR		
	NITROGEN*⁄	PHOSPHORUS*⁄	SEDIMENT
Agriculture	1,080	250	258,962
Urban	690	60	6,730
Silviculture	*	10	490,421
Mineral Extraction	*	*	
Construction	*	*	28,879
Roads	*	20	167,671
Streambanks	*	10	47,000
Septic Tanks	140	*	
Point Sources	50	90	
Groundwater	190	*	
Background	130	60	
Total	2280	500	999,663

- Rounded to the nearest ten tons
- *⁄ Nutrient flux at the state line will be considerably less than the values given because of in stream assimilation, and nutrient loss due to filtration before it reaches the streams.

TABLE 5

SEDIMENT POTENTIAL

SOURCE	TONS PER YEAR X TRANSPORT FACTOR	TONS DELIVERED TO STREAM
Farms	258,962 X 15%=	38,844
Woodland	490,421 X 15%=	73,563
Roads	167,671 X 50%=	83,835
Construction	28,879 X 75%=	21,659
Streambanks	47,000 X 100%=	47,000
Urban	6,730 X 75%=	5,048
	Total	269,949

REFERENCES

1. EPA 600/2-79-059, Animal Waste Utilization on Cropland and Pastureland, Table 18

2. Scott, et. al. The Impact of Land Application of Poultry Litter and Swine Manure on Ground and Surface Water Quality in Western Arkansas, U of A Dept. of Agronomy, 1992 pp 87.

3. Kelly Gage, U of A Cooperative Extension Service, personal communication, 6-23-94

4. Clary, Warren P. and Webster, Bert F. "Managing Grazing of Riparian Areas in the Intermountain Region"

5. Arkansas Department of Pollution Control and Ecology, Water Quality Inventory Report, 1992.

6. Terrene Institute, Urbanization and Water Quality. March, 1994, pp 1.

7. U. S. EPA, "Rural Roads: Pollution Prevention and Control Measures," September 1992

8. U. S. Geological Survey, Water Resources Investigations Report 88-4112, Table 70.

9. Impacts of Gravel Mining On Fish Communities In Those Ozark Streams: by Madeleine M. Lyttle, University of Arkansas, Fayetteville, AR. 1993

10. Arkansas' Nonpoint Source Pollution Assessment Summary.

11. Water Quality; Prevention, Identification, and Management of Diffuse Pollution: by Vladimir Novotny, Milwaukee, Wisconsin, and Harvey Olem, Herndon, Virginia.

BEST MANAGEMENT PRACTICES

Best Management Practices (BMP's)

Best management practices here can be defined as: a combination of land use, conservation practices and management techniques which, when applied to a unit of land, will result in the reduction of nonpoint source pollution. Each probable source should utilize a system of these BMP's to minimize pollutants from those sources.

A list of BMP'S which are suggested for the Illinois River Basin is presented in Table 5. This list is not all inclusive, and may be revised as better BMP's are developed. The BMP's are listed for each source or potential source of nutrient loading to the Illinois River. In general BMP's which reduce nutrient loading to the river also reduce pollutants going into all waters of the area including underground.

Table 5
BEST MANAGEMENT PRACTICES

SOURCE	BEST MANAGEMENT PRACTICE
AGRICULTURE	1. Dead poultry composting
	2. Critical area planting
	3. Sediment basin
	4. Waste treatment lagoon
	5. Filter Strip
	6. Waste storage structure
	7. Diversions
	8. Deferred grazing
	9. Field border
	10. Grade stabilization structure
	11. Grassed waterway or outlet

	12. Waste storage pond
AGRICULTURE	13. Irrigation system (sprinkler) 14. Roof runoff management 15. Waste Utilization 16. Conservation tillage system 17. No till 18. Pasture and hayland management 19. Critical area treatment
SILVICULTURE	1. When possible harvest only when the ground is dry to minimize soil disturbance from skidding and hauling equipment. 2. Leave buffer strips along streams undisturbed. 3. Minimize streamcrossing with hauling and skidding equipment. Where stream crossings can not be avoided the most direct route should be used, taking advantage of natural fords with firm bottoms, stable banks and gentle slopes along approaches. 4. Skid trails should be located so they do not run parallel to streams where such trails are within the average high water level of the stream. 5. Revegetate skid trails and haul roads upon completion of the harvesting operation. 6. Maintenance of equipment should be done away from streams and lakes so that accidental spills will not result in water contamination. 7. An all age woodland management system should be used if possible. During harvesting or other silvicultural operations the following guidelines should be followed: 8. Plans should be made to minimize disturbance of streams and/or buffer zones.

SOURCE	BEST MANAGEMENT PRACTICES
SILVICULTURE	9. Equipment operators should be trained to minimize soil disturbance. 10. Soil in windrows should be kept to a minimum. 11. Windrows should not be located in buffer zones. 12. Avoid disking on steep slopes and on slopes with thin or highly erodible soils. 13. When ripping, follow the contour.
ROADS	1. Establish adequate road ditches. 2. Construct turnouts to disburse water in small amounts into vegetated areas. 3. Vegetate all disturbed areas except the road surface. 4. Crown roadbeds so that they do not act as channels. 5. Maintain non-erosive velocity in ditches 6. Re-establish vegetation after cleansing ditches. 7. Hard surface roads.
STREAMBANKS	1. Buffer zones to protect riparian area. 2. Streambank seeding. 3. Grade stabilization structure. 4. Vegetated revetments 5. Improved boat launching facilities/access. 6. Critical area treatment.
MINING	1. Critical area treatment 2. Grade stabilization structures 3. Enforcement of proposed PC&E regulations for gravel mining in streams.

SOURCE	BEST MANAGEMENT PRACTICES
CONSTRUCTION SITES	1. Limiting percent of area that can be disturbed 2. Temporary sediment basin 3. Temporary filter to filter runoff (such as straw mulch or hay bale retainers) 4. Revegetate as soon as possible after disturbance 5. Amend existing stormwater ordinances to include sediment control. 6. Sediment fences.
ONSITE DOMESTIC WASTE WATER DISPOSAL	1. Inspect existing septic tank systems periodically to see that regular maintenance is performed and that the system is functioning properly. 2. Encourage, through the county government, utility companies to require an inspection of the waste water disposal facilities before meter hookups are made.
URBAN	1. Educate the public about the hazards of fertilizers and pesticides used in commercial lawn care and grounds maintenance operations and the alternative treatments. 2. Educate the public on how to reduce litter and properly dispose of pet wastes and household pollutants. 3. Respect contours and natural features of the landscape (example, avoid stream valleys and excessively steep slopes). 4. Use down zoning to restrain development in critical areas. 5. Specify minimum lot size. 6. Limit development by soil type or proximity to water bodies. 7. Identify sensitive areas and restrict development in them. 8. Limit density of development. 9. Limit percent of impervious cover. 10 Preserve 100 yr. flood plain.

SOURCE	BEST MANAGEMENT PRACTICE
URBAN	11. Prohibit clearing and grading on excessively steep slopes.
	12. Reserve a minimum percentage of open space on each development.
	13. Revegetate immediately or as soon as possible after construction.
	14. Provide for storm water collection or treatment, such as sediment control basins or wet ponds to accommodate large storms.
	15. Develop collection systems that store the first 1/2 inch of runoff (that typically contains most contaminates) during a storm.
	16. Eliminate stormwater entering sewer drains and waste water treatment plants.
	17. Proper use of temporary erosion and sediment control at construction sites, such as temporary holding ponds, mulching, and hay bale retainers.
	18. Ordinances which restrict or control the use of pesticides, fertilizers, or other chemicals, and that regulate waste generation and disposal.
	19. Establish catch basin drainage programs.
	20. Redesign road salting programs to minimize the salt quantity and, where feasible, use an alternative route.
	21. Develop urban forestry plans

PROGRAMS

PROGRAMS AND SOURCES OF FUNDING

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)

NATURAL RESOURCE CONSERVATION SERVICE (NRCS)

On October 20, 1994 the Secretary of Agriculture created the Natural Resources Conservation Service (NRCS). The NRCS combines most of the authorities of the former Soil Conservation Service, as well as five Natural Resource Conservation cost-share programs previously administered by other USDA agencies. These include: Wetlands Reserve Program, Water Bank Program, Colorado River Basin Salinity Control Program, Forestry Incentives Program, and Farms for the Future.

NRCS provides actual on-site technical assistance for the planning and application of needed conservation practices. These efforts have historically been with landowners and farmers who voluntarily desired to manage and improve their soil and water resources or where technical assistance was required due to federal cost-share provisions. Technical assistance has been directed toward farm benefits of topsoil retention, improvement or reduced runoff. Recent program emphasis has been redirected to off farm or public benefits of erosion control, sediment damage reduction and an improvement in water quality from reduced nutrient and sediment loadings.

The technical assistance is basically subdivided into a planning and application workload. This concept of planning and application is currently being utilized under programs such as: a) Conservation Operations where NRCS, under enabling legislation provides technical assistance to landowners through local Soil and Water Conservation Districts (CDs); b) Agricultural Stabilization and Conservation Service's Agriculture Conservation Program for the installation of practices under the annual and long-term cost-share programs; c) the conservation provisions of the 1985 Food Security Act and d) specific watershed activities such as the Land Treatment project under the PL-83-566 Program.

Conservation Operations:

Under Public Law 74-46, the NRCS is charged with a number of general technical responsibilities. Conservation Technical Assistance is to be provided to cooperators of local conservation districts and other landusers in the planning and application of conservation treatments to control erosion and improve the quality of soil resources, improve and conserve water, enhance wildlife habitat, conserve energy, improve woodland, pasture and range conditions, and reduce upstream flooding; all to protect and enhance the natural resource base. The NRCS is also responsible for a variety of inventory and information product development responsibilities that form the technical backbone both for USDA programs and for activities pertinent to the Illinois River Management Plans. The NRCS gathers the data that appears in the published Soil Surveys. The NRCS also takes a central role in developing the technical specifications for resource management systems including water quality Best Management Practices.

Watershed Protection & Flood Prevention Act (PL-566):

The PL-83-566 small watershed program, administered by NRCS, addresses several concerns on hydrologic bases including water quality protection and improvement (agricultural water management). Project measures for water quality protection and improvement consist of land treatment, nonstructural measures and structural measures installed for the primary purpose of reducing water quality impairments caused by pollutants, including sediment, primarily from agricultural sources. Through the program, NRCS can provide technical assistance, cost-sharing for installing certain land treatment practices and cost-sharing for certain structural and nonstructural water quality measures. The Muddy Fork PL-566 project could possibly be re-opened, expanded to 250,000 acres, and revised to include land application practices for water quality. A second PL-566 project could be developed to cover the remainder of the river basin.

Resource Conservation and Development (RC&D):

Under Public Laws 87-703 and 97-98, the NRCS was empowered to assist locally sponsored Resource Conservation and Development Projects to conduct programs of land conservation in areas where acceleration of present conservation activities are needed and the projects would add economic opportunities to a local area. While the "projects" could be one-time affairs, Arkansas and most other states have encouraged local sponsors in multi-county areas to create ongoing organizations. RC&D programs allow the NRCS to provide technical assistance for problems that can potentially involve a multi-county area. From an early date, RC&D projects have been encouraged to consider matters having to do with nonpoint source pollution of water. RC&Ds can apply for support under a variety of NRCS or other USDA assistance programs. The flexibility of the RC&D concept and the interest of the RC&Ds in pooling resources from all available funding sources to tackle problems like water quality issues, allows the tapping of NRCS expertise and adds a source of solid regional support for water quality implementation work.

Farm Bill Activities:

While most of the administrative aspects of the 1985 Farm Bill programs fall under the ASCS, the NRCS and local Conservation Districts play important technical roles. Any Conservation Plan of Operations (CPOs) required under the Farm Bill are developed by NRCS employees and must be approved by the local Conservation District's Board of Directors. Where a landholding has particularly severe erosion or other resource problems, it may qualify for the Conservation Reserve Program (CRP). Where the land does not qualify for the CRP, but still needs conservation measures, district or NRCS personnel will often be in a position to point out available USDA assistance programs that could help the landowner implement needed management practices. Where land with Farmers Home Administration loans has reverted back to the federal government, the NRCS is required to design a conservation plan which is then incorporated into the title in the form of conservation easements before the landholding can be resold. All these activities have water quality dimensions, and NRCS and district involvement in Farm Bill programs is doing much to educate the farm community on water quality issues.

Forestry Incentive Program (FIP):

FIP is a special incentive program where cost-share is made available to woodland owners in addition to the regular ACP cost-share program. Under FIP woodland owners with 1,000 acres or less and that are eligible can receive up to 50% of the cost of tree planting, timber stand improvement, and site preparation for natural reseeding, up to a maximum of $10,000.00 per year.

AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE (ASCS)

A number of federal agricultural programs, as provided for by federal law, are administered by ASCS state and county committees (local farmers) working under the general direction of the Agricultural Stabilization and Conservation Service of the USDA Technical and educational assistance is provided by Natural Resource Conservation Service (NRCS), U.S. Forest Service (USFS), Arkansas Forestry Commission (AFC) and the Cooperative Extension Service (CES).

Agricultural Conservation Program (ACP):

ACP as administered by ASCS is designed to: help prevent soil erosion and water pollution; protect and improve productive farm and ranch land; conserve water used in agriculture; preserve and develop wildlife habitat and encourage energy conservation. The program provides cost-sharing assistance to farmers to carry out conservation and environmental protection practices on agricultural land that results in long term public benefits. Cost share under ACP is at a 50% rate with a $3,500 per year limit per farm.

Water Quality Incentive Program (WQIP):

This is an incentive program to improve water quality. The WQIP provides special funding above the counties normal operations for targeted watersheds. Watersheds selected for WQIP funding are nominated by the ASCS interagency coreteam and approved by the national committee. WQIP watersheds must be identified as priority areas by the states NPS Management Program. The WQIP differs from the ACP in that incentive payments are made for management rather than structural practices. The Clear Creek Watershed in Washington County was funded by the WQIP in 1993 and the Osage Creek in Benton County in 1994. Funding has been requested for Flint Creek in 1995.

Stewardship Incentive program (SIP):

SIP is a special program established to cost share silviculture BMP's which have special water quality benefits; especially those practices that protect riparion areas and provide benefits to fish and wildlife. It differs from FIP by including many more activities to be cost shared. The SIP program includes cost sharing for the enhancement of fish, birds, wildlife, rare and endangered plants, historic areas and water quality.

Long Term Agreement (LTA):

This program guarantees cost-share assistance for landowners to carry out a conservation plan over a period of years; usually three to five years. These plans are developed through NRCS. The advantage of LTA's is that up to $17,500 cost share is available for accelerated payment on structural practices. The average cost share may not exceed $3,500 per year for the period of the agreement.

Conservation Compliance Provisions of the Farm Bill:

Since 1985, the ASCS has been centrally involved in the Conservation Compliance provisions of the 1985 Farm Bill. A brief description of these provisions is as follows: Any person who plants an agricultural commodity on highly erodible land without using an approved Conservation Plan of Operations (CPO) is not eligible for USDA program benefits. The program benefits that could be affected are ASCS program payments, ASCS commodity loans payments, Federal Crop Insurance payments, and Farmers Home Administration loans. This will encourage the use of agricultural lands in a proper manner to lessen the problems of sedimentation and nonpoint source related agricultural pollution. The Conservation Compliance provisions require all producers requesting USDA benefits to have an approved CPO by the year 1990 and have the CPO in effect by the year 1995 in order to remain eligible for USDA program benefits.

THE UNITED STATES GEOLOGICAL SURVEY (USGS)

The United States Geological Survey (USGS) is primarily a data collection and analysis agency. While its role in the management aspects of Arkansas's Section 319 program are therefore indirect, the USGS is a source of much useful information to guide planning and management decisions, especially in the area of groundwater. For both ground and surface water projects, the USGS can assist state environmental agencies through its Cooperative Program. The basic geohydrological data yielded from these groundwater studies will be an important source of information as Arkansas moves to implement a Wellhead Protection Program for municipal water well systems. The USGS can conduct water monitoring programs for the state at a 50% Non Federal Matching Rate

ARKANSAS SOIL AND WATER CONSERVATION COMMISSION (ASWCC)

The Arkansas Soil and Water Conservation Commission (ASWCC) coordinates the statewide agricultural Nonpoint Source (NPS) pollution program and has been designated as the lead management agency for implementation of the Section 319 program.. The ASWCC is responsible for the direction and coordination of the agriculture program and for reporting progress annually to the EPA. In addition to these leadership activities the ASWCC agricultural programs include the following main areas:

1) Technical/Administrative Assistance to Soil and Water Conservation Districts (CDs),
2) Agricultural Education Program,
3) Agricultural Demonstration/Research Projects and
4) Nutrient Management Program. These programs are a major component of the management program for the control of agricultural NPS pollution.

Under the provisions of the Arkansas Water Quality Management Plan (AWQMP), ASWCC and participating CDs have been designated by the Governor as the management agency for agriculture. They plan, manage and implement portions of the AWQMP, particularly those portions involving nonpoint source pollution control for sediment and organic (animal waste) pollutants. They will also provide on-site best management practice (BMP) planning assistance, technical assistance, and information for best management practice installation. They will also locate sites and install research and monitoring devices as money, personnel, and time permit.

Pollution Abatement Bonds:

The ASWCC can provide financial assistance to any existing political subdivision of the state and any special improvement district through its Waste Disposal and Pollution Abatement General Obligation Bond Program. Loans can be made through this program to eligible entities wishing to construct point or nonpoint source pollution control facilities. Funding may be available for purchase of equipment for NPS management.

THE ENVIRONMENTAL PROTECTION AGENCY (EPA)

Section (319) h

Section (319) h funds would become available to state agencies through the ASWCC as the lead NPS State agency if and when the state's NPS Pollution Management Program is updated to include their particular activities and BMP's.

Many of EPA's initiatives are carried out on a nationwide scale and involve coordination efforts with other federal agencies that can be useful for individual states in the development of their Section 319 programs. The Section 319 program entails a substantial degree of interagency coordination and cooperation. EPA also encourages the fullest possible use of funding mechanisms currently contained in the Clean Water Act. These could include new funding vehicles introduced with the Water Quality Act of 1987 but would also encompass skillful use of grants that have long been part of the Clean Water Act.

Environmental Education

The US EPA provides grants ranging from $5,000 to $250,000 for implementation of Environmental Education programs. Projects under $25,000 compete on a regional level for funding and larger projects compete nationally. State and local governments and not-for-profit organizations are eligible for Environmental Education.

SOIL AND WATER CONSERVATION DISTRICTS (CDs)

Conservation Districts are uniquely qualified and equipped to plan, manage, and implement portions of the Illinois River Water Management Plan, particularly those involving nonpoint source pollution control for sediment, animal waste, and nutrients.

CDs formulate long-range programs and develop annual plans of work for resource conservation activities. These programs are developed and implemented with assistance from state and federal agencies. These programs and annual plans may very easily be expanded to include the goals and objectives of the Illinois River Management Plan.

CDs have the legal structures to obtain voluntary land user cooperation and participation in resource conservation and management programs. Such cooperation and participation includes access to private lands for those CDs and agency representatives who may need to conduct nonpoint pollution source investigations; provide on-site best management practices (BMPs) planning assistance; provide technical assistance and information for BMP installation; and locate sites and install resource and monitoring devices.

CDs have the responsibility to provide land users a plan which will solve soil erosion and runoff problems. The land user is given technical assistance to carry out the measures as planned. when fully implemented, a conservation plan will provide the land user with the currently available best management practices to control runoff and erosion for each acre in an orderly, effective manner.

USDA, NRCS personnel are assigned to CDs based on formal working arrangements. The US Forest Service, working principally through the Arkansas Forestry Commission, is a valuable source of technical assistance to districts. Assistance from the several water resources oriented agencies have beneficial district programs. Close working relationships have been maintained with the Corps of Engineers on their flood control and irrigation projects to assess on-farm systems as appropriately coordinated with the project developments. The U.S. Geological Survey supplies a great deal of base data on water resources especially useful for planning and layout purposes for dealing with problems involving water supply, flooding, and other water management activities.

Since 1991, section 319 (h)funds from EPA and ASWCC have been used to employ water quality technicians in each of the CD's in the Illinois River Basin. These technicians prepare management plans for poultry farms and assist in implementing BMP's for reducing NPS pollutant loads and preventing negative impacts to water quality.

ARKANSAS DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY (ADPC&E)

The ADPC&E regulates the confined animal industry in Arkansas through the State Permits Branch in its Water Division. Farms with liquid waste handling and storage systems, such as most swine farms and poultry layer farms and some dairy farms, require a State Water (no discharge) Permit.

State Water Permits are written and reviewed by engineers in the State Permits Branch. In the permit review process, the draft permits are reviewed by the Branch manager, an Engineer Supervisor, and then by the Assistant Chief of the Water Division, a registered professional engineer, before being signed by the Director of ADPC&E.

The Program Coordinator of the Branch prepares enforcement cases against permittees who are not in compliance with their permits and other violators without permits.

The permits insure that the farms have waste holding facilities which consist of properly constructed Best Management Practices (BMPs) to prevent spillage, leakage, or runoff, and have adequate capacity to hold the waste, wash water, and precipitation for four months of wet weather and a 25-year, 24-hour storm event. The BMPs for most confined animal operations consist of waste management plans, waste storage ponds, waste treatment lagoons, water diversion structures, debris basins, and land application equipment.

The waste management plans submitted in applications for the permits provide the permittees with the operating plans to properly handle and store the wastewater and to properly apply the wastewater to pasture land as fertilizer, based on agronomic rates agreed upon by ADPC&E, CES and the USDA Natural Resource Conservation Service (NRCS). The NRCS normally prepares the waste management plans and performs initial site investigations for the farmers. The BMPs incorporated in the NRCS prepared waste management plans are based on current engineering practices and are not subject to voluntary implementation, but are required before ADPC&E will issue a permit.

A two stage permitting process has been developed by ADPC&E and NRCS in a cooperative effort to insure that waste handling and holding facilities, such as piping, debris basins, and holding ponds, are properly constructed. The following scenario illustrates the process. ADPC&E reviews and approves the permit application of a farm for which the NRCS has prepared the waste management plan, then issues a construction permit for the facility. During construction the farmer notifies NRCS, and NRCS personnel inspect the waste management facility during and after construction. The NRCS notifies ADPC&E if construction has been done in accordance with design plans and construction standards, and ADPC&E then issues an operation permit for the farm. The two-stage process was begun in February 1989, and is expected to result in better permit compliance.

Since 1993 liquid waste permit applicants are required to attend four hours of training in waste management prior to receipt of a permit. Permit holders must attend four hours of waste management training annually to maintain their permit.

ADPC&E administers the state revolving fund. This is a possible source of funds for nonpoint source projects.

COOPERATIVE EXTENSION SERVICE (CES)

The Cooperative Extension Service represents a complicated partnership involving the USDA-Extension Service (a federal agency within the USDA), the land grant college system (principally the University of Arkansas at Favetteville {UAF}, Department of Agriculture) , various aspects of the USDA Agricultural Research Service (ARS) , and local Extension Offices in each of Arkansas's 75 counties. The overall idea is that research activities carried out through the ARS at various Agricultural Research Stations along with research (largely federally financed) at the land grant colleges should provide an extensive applied knowledge base. Through publications, demonstration projects, and other activities, this knowledge is progressively made available to the general populace in educational efforts centering largely on the county extension offices. Among the most important services offered through the CES network is a mechanism for performing soil analyses. Landowners can submit soil samples to county extension offices, which can then be processed at the Soils Laboratory. Soil testing forms the backbone of any meaningful nutrient management program involving the economic and environmentally sound use of commercial or animal fertilizers. The University of Arkansas Diagnostic Service Laboratory provides manure analysis for a fee. The CES, University of Arkansas assists producers with manure analysis. Recently, the USDA in a Memorandum of Understanding with the EPA has identified the cooperative Extension Service as the main provider of educational services relating to agricultural nonpoint source pollution management, drawing on technical information to be provided largely through the NRCS. For some types of BMPs, technical services from specialists affiliated with UAF are a vital ingredient. Finally, the CES helps make the fullest use of work stemming from the Agricultural Research Service.

The Cooperative Extension Service provides a major educational role in Arkansas's water quality efforts dealing with agriculture. Current efforts are directed toward the need for and benefits from best management practices and better farm management of fertilizer, pesticides and animal wastes.

ARKANSAS LIVESTOCK & POULTRY COMMISSION (AL&PC):

The Arkansas Livestock and Poultry Commission was created by Act 87 of 1963. Full authority for the control, suppression and eradication of livestock and poultry diseases and pests and supervision of livestock and poultry sanitary work in this state is vested in the commission. Regulating the proper disposal of dead animals is an important function of the AL&PC.

ARKANSAS FORESTRY COMMISSION (AFC)

The Arkansas Forestry Commission (AFC) is the lead management agency for the silvicultural portion of the Arkansas Water Quality Management plan. The AFC in cooperation with the forest industry has promoted the use of Forestry BMP's and the monitoring of silvicultural operations for their implementation and effectiveness. The AFC in it's monitoring program has applied the modified forestry Universal Soil Loss Equation on nearly every track monitored. To carry out its management programs the AFC cooperates with the Soil and Water Conservation Commission, the Conservation Districts, The Natural Resource Conservation Service, and many other agencies and organizations involved with Nonpoint Source Pollution.

The AFC will play a major role in the planning and application of BMP's on private forest land in the project area.

MUNICIPAL GOVERNMENTS

Zoning Ordinances: Establish land use within the cities and set minimum standards. These standards regulate such things as lot size, maximum amount of ground that can be covered with impervious material, etc. They establish open area, delineate flood plains and regulate development in these areas.

Drainage Ordinances: Some cities have drainage ordinances which establish peak flow rates from developing areas and set minimum standards for the design and operation of drainage structures.. This helps to control scouring and flooding downstream, and act as temporary sediment basins.

Subdivision Regulations and Standards and Specifications: These regulations establish the requirements for development of property including required improvements (streets, utilities and drainage) and plat review.

National Pollution Discharge Elimination System Permits (NPDES): This program is handled in Arkansas by the Arkansas Department of Pollution Control and Ecology. This is the permitting system which regulates the discharge of liquid animal waste, and land application of sewage sludge. These same ordinances could be used to facilitate the use of Best Management Practices.

COUNTY GOVERNMENTS

Counties have drainage ordinances and subdivision regulations. These could be vehicles for more substantial regulation which could facilitate development , and application, of Best Management Practices within new developments in the county. County road maintenance programs can be modified to treat critical areas.

ARKANSAS HIGHWAY AND TRANSPORTATION DEPARTMENT (AHTD):

AHTD has standards and specifications, for new construction, which include erosion control measures. These regulations include both temporary and permanent measures. Temporary measures usually are applied during construction, but may be applied any time permanent erosion and sediment control measures are delayed. Temporary measures include such things as mulching, temporary vegetation, and hay-bale retainers. Permanent measures include, but are not limited to, permanent vegetative cover, rock rip-rap, and concrete.

ARKANSAS HEALTH DEPARTMENT (AHD):

All representatives and installers of sewage systems in Arkansas, including septic systems, are governed by rules and regulations pertaining to sewage disposal systems as approved in Acts 402-1977 and 708-1983. These representatives and installers must be registered by AHD. Each representative and installer is registered only after an examination and compliance with the provisions of the rules and regulations. Representatives must attend at least one training course each year in order to maintain registration.

AHD also inspects all grade A dairies in the state on a regular basis. Inspectors check in and around the milking barn to see that the area is kept clean, and take milk samples to be tested for bacteria. Bacteria counts, and general cleanliness must be kept within tolerable limits or the unit can loose its grade A status.

Implementation:

The following sections provide a plan for implementation of Best Management Practices for each identified category of pollution in the basin. The recommendations are all made pending available funding. Where appropriate funding sources are known, they are given with the recommendation. The agencies involved in implementation of this plan will seek sources of funding from federal, state or local sources.

Planning and Evaluation:

This plan is a long range planning tool for implementation of pollution control activities in the Illinois River basin. This tool should be a living document that evolves to meet the changing situation in the river basin. To assure that the plan is implemented it is recommended that the Illinois River Advisory Panel and the state's Nonpoint Source Advisory panel be merged and that the panel make an annual evaluation of progress in meeting the goals of the plan. The panel should also recommend modifications to the implementation schedule as the need arises.

Efforts are underway to monitor the status of streambanks in the Illinois River basin and to monitor typical watersheds to refine the estimates of pollutant loading from various sources. These efforts will establish baseline data on the condition of the riparian zone along the stream and establish a list of priority watersheds for project implementation. This list will be a tool for allocating limited resources when necessary. Section 319(h) and 104(b) funding has been used for these monitoring projects.

In addition to the monitoring mentioned above, the ASWCC has conducted rapid bioassessments at twenty five sites in the watershed to establish a baseline on the physical and biological condition of the streams in the basin. The ASWCC has also used 319(h) funding since 1991 to monitor Moores Creek as an evaluation of the USDA Muddy Fork Hydrologic Unit Area Project. The results of this project are summarized as follows:

Water quality at five stream sites and four pastures in the Lincoln Lake basin was monitored from September 1991 to April 1994. The monitoring was conducted concurrently with HUA activities in the region to improve the quality of water entering Lincoln Lake. The goals of the monitoring were to demonstrate (a) the overall effectiveness of HUA activities within the basin and (b) the effectiveness of nutrient management, a specific BMP implemented in association with HUA activities.

The data from the stream monitoring sites indicated a significantly decreasing trend in stream flow concentrations of nitrogen (N) and sometimes chemical oxygen demand (COD), while concentrations of phosphorus (P), fecal coliform (FC), and fecal streptococcii (FS) generally did not change over the monitored period. The information collected from the four fields indicated that nutrient management based on P as the limiting nutrient (i.e., applying inorganic fertilizer to soils with sufficient P content) decreased both

soil and runoff P concentrations. However, no significant increases in soil or runoff P concentrations were observed for fields in which nutrient management was based on N as the limiting nutrient (i.e., applying animal manure to soils already having sufficient P).

Apart from the HUA program, there were no reported activities within the Lincoln Lake basin that would have caused the water quality changes observed over the monitoring period. Furthermore, the water quality changes that were observed are consistent with the impacts that SCS and CES activities would be expected to produce. The improving trend in the quality of Lincoln Lake's tributaries is thus attributed to the HUA program within the basin; i.e., the programs were effective in positively influencing water quality in the basin. The data collected from monitoring the four small fields demonstrate the proper nutrient management can lead to agronomically small losses of nutrients in runoff. The information further points out that if P is the water quality concern, then an appropriate nutrient management strategy can significantly reduce runoff losses of P in perhaps a relatively short time.

Ambient water quality monitoring is conducted by the Arkansas Department of Pollution Control and Ecology at six stations in the basin. These stations should be maintained for the foreseeable future.

The ASWCC will assign an employee as plan manager of the Illinois River basin. The manager's duties would include implementation of the management plan through coordination with the various agencies and governments responsible for the different aspects of the plan. The manager would also keep a record of implementation activities and report on them annually to the NPS advisory panel for review and evaluation.

In the absence of numeric standards for nutrient and sediment loading it is very difficult to set goals for the different aspects of the management program. The objective of the management plan is to restore all beneficial uses to the streams in the basin. Currently, the goal is the implementation of the best management practices BMPs for all sources of nonpoint source pollution in the basin. The BMPs are in effect the best available affordable technology for managing nonpoint source pollution. If fully implemented, BMPs should result in minimization of the impacts resulting from activities in the basin although, it is not known if full restoration of beneficial uses will be realized.

Future efforts should be toward establishing water quality driven targets for loading of the different parameters. The total maximum daily load (TMDL) process is a method of establishing loading goals for different sources of pollution i.e. point sources, nonpoint sources and background loads. While this process indicates daily loads, the process is equally effective for annual loads or other periods. Through the TMDL process, target loads for specific parameters based on the desired degree of support of the designated uses. For example, a TMDL for phosphorus could be set at Lake Tenkiller based on the desired trophic state of the lake. Based on the TMDL for the lake, the stream could be computer modeled and target TMDLs set for watersheds in Arkansas. Basin planners would then have a target by which the effectiveness of the implemented BMPs could be evaluated.

It is recommended that a TMDL be set for phosphorus loading of the Illinois River as a target for water quality improvement. The Arkansas / Oklahoma Arkansas River Compact should be responsible for establishment of the target TMDL.

It is highly recommended that the Arkansas Water Resource Center use its GIS and water quality modeling abilities to establish a nutrient loading model of the river basin. Several adequate models exist including AGNPS., Gleams, and EPIC. These models require extensive calibration to local conditions. Oklahoma State University is also developing a model titled SIMPLE that can be used to model phosphorus export from agriculture watersheds. If successful, this model will be very applicable to Arkansas' portion of the basin. The AWRC should also maintain a nutrient flux model of the basin such as QUAL2E. This model will be valuable as an evaluation tool and will also make innovative practices such as nutrient trading possible.

To facilitate evaluation of progress in meeting the goals of this management plan, the ASWCC will repeat the Bioassessments of the basin every other year, and the results maintained in a data base at the ASWCC. The streambank survey will be repeated at least once a decade and the results compared to historical data. The ASWCC will also conduct sampling programs in the Muddy Fork project area and in a representative number of WQIP project areas. This data will be augmented by the ongoing ambient water quality monitoring conducted by the ADPC&E. Progress will be measured by trends in the data from these various sources.

The annual evaluation of the program is to be based on the water quality samples collected under the various programs and reports of BMP and program implementation provided by the basin manager. The NPS advisory panel will review the data and recommend continuous revision of the programs as necessary. The basin manager will be responsible for preparation of a report summarizing the recommendations of the panel.

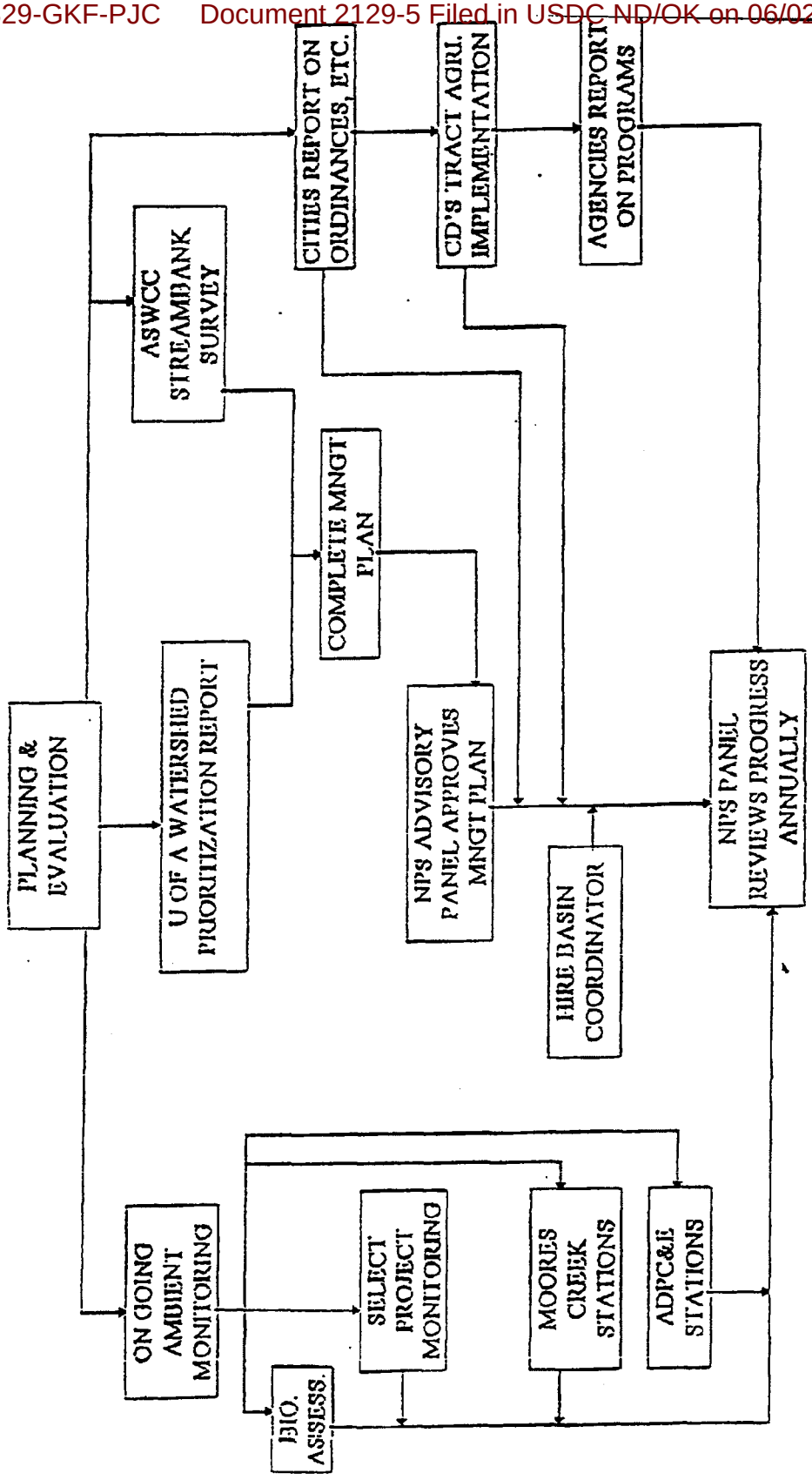

PLANNING & EVALUATION
ASWCC STREAMBANK SURVEY
CITIES REPORT ON ORDINANCES, ETC.
CD'S TRACT AGRI. IMPLEMENTATION
AGENCIES REPORT ON PROGRAMS
U OF A WATERSHED PRIORITIZATION REPORT
COMPLETE MNGT PLAN
NPS ADVISORY PANEL APPROVES MNGT PLAN
HIRE BASIN COORDINATOR
NPS PANEL REVIEWS PROGRESS ANNUALLY
ON GOING AMBIENT MONITORING
SELECT PROJECT MONITORING
MOORES CREEK STATIONS
ADPC&E STATIONS
BIO. ASSESS.

Figure 6

The goal of the agriculture component of this plan is that 80 percent of the farms in the basin develop and implement management plans which:

1. Manage fertilizer and animal waste so that nutrient and bacterial runoff is held to a minimum. This should include proper storage and handling of animal wastes, and optimum rates and timing of application of both animal waste and commercial fertilizer.
2. Properly dispose of dead animals.
3. Minimize erosion from cropland, pasture, woodland, and streambanks.
4. Improve fish and wildlife habitat.
5. Inhance recreation opportunities, and beautify the farms.

To accomplish this goal the following outline is presented.

1. Set Priorities:

Develop a priority list of watersheds to be developed. The Arkansas Water Resource center will prioritize the watersheds in the basin by July 1995. This prioritization will be based on phosphorus loading to the streams.

2. Technical Assistance:

Technical assistance will be furnished through the two conservation districts. The Natural Resource Conservation Service will continue to give assistance through their regular Conservation Operations. NRCS could also give technical assistance through development of PL-83-566 projects within the area. The ASWCC recommends that the Muddy Fork PL-83-566 project be reopened, expanded to 250,000 acres, and another project area developed to cover the remainder of the area. The ASWCC will furnish technical assistance for poultry waste management planning through its water quality technician project. The Arkansas Forestry Commission will furnish technical assistance to landowners for establishing BMP's on private woodland. The Cooperative Extension Service will provide soil testing and manure testing services to support the technical assistance effort.

3. Financial Assistance:

Financial assistance to establish BMP's could be available through the Agricultural Stabilization and Conservation Service (ASCS). Regular ACP funds will be available to landowners in the entire watershed. 319(h) funds will be used to continue monitoring work in the Moores Creek area for three more years, and bioassessments for two years. All areas of the watershed may be eligible for FIP cost share for tree planting, timber stand improvement, and site preparation for natural reseeding. Cost share may be available to qualified landowners through the SIP program for application of BMP's which improve water quality, and which protect riparian areas for the benefit of fish and wildlife. Additional cost share funds could be available through ASCS for landowners in WQIP areas for Management Practices that improve water quality.

Agriculture:

It has been estimated (see Table 4) that agriculture is the main contributor of nonpoint pollution within the Illinois River Basin in Arkansas. The United States Department of Agriculture USDA Muddy Fork Hydrologic Unit Area (HUA) project on 4700 acres within the Illinois River Basin and other USDA research work has demonstrated that the most practical way to control pollution from farms is by the application of Best Management Practices (BMP's). This can best be accomplished by using a comprehensive approach involving a complete information and education program coupled with adequate technical and financial assistance.

There are a total of approximately 401,500 acres in farms in the basin. Farm size averages 120 acres. It is impossible, at this time, to determine how much pollution from farms can be present without impairing the water quality of the area. We do, however, believe that pollution from farms can be reduced to an acceptable level. This assumption is based upon the participation of farmers in some special project areas within the river basin. In the past three years, Nutrient Management Plans have been developed on 741 of a total of approximately 3,345 farms in the basin. Most of these plans have been developed on farms with confinement feeding and/or dairy operations. Approximately 1300 of the total farms are of this type. Data from quarterly reports[1] submitted to the ASWCC by Conservation District Water Quality Technicians in the Illinois River basin indicates that over eighty percent (80%) of livestock producers contacted have agreed to cooperate with development of a manure management plan. These same reports indicate that when follow-up visits are made to the farm one year after completion of the plan, over eighty percent (80%) of the BMPs planned are implemented.

The magnitude of potential pollutant load reduction from implementation of agricultural BMPs is not currently known. Data from the Moores Creek Monitoring project[2] in Washington County seems to indicate that in the Illinois River basin nitrogen and chemical oxygen demand loading of streams will respond quickly to BMP implementation. Reductions of from 14 to 75% per year were measured in these parameters. Phosphorus and bacterial loading on the other hand do not respond nearly so quickly. Plot scale work at the University of Arkansas[3, 4] has indicated that vegetated filter strips can be very effective in reducing suspended solids, nutrients and bacteria from runoff from waste application sites. Suspended solids efficiencies of 34% for plots receiving poultry litter and 61% for plots receiving swine manure were demonstrated. Efficiency for removal of the nutrient species ranged from 80 to 99 percent for filter strips 4 to 21 meters wide. Efficiencies for actual field conditions would likely be somewhat less. The management practices being implemented are identified by the Natural Resources Conservation Commission as being effective in management of nutrients (nitrogen and phosphorus), sediments, and bacteria[5]. Therefore a substantial load reduction from the agricultural contribution to stream loading should be realized.

The Natural Resource Conservation Service could also give financial assistance through the PL-83-566 Program.

4. Education and Training:

The cooperative Extension Service (CES) has developed training programs for liquid waste management, and for poultry and dairy dry waste management. These programs will be presented within each WQIP area when the project is initiated and annually there after. In addition CES will develop a training program for the management of unconfined cattle. This program will also be presented annually within each active project area. This program could be developed using 319(h) money as a part of the Spring River Pasture Management Program, in cooperation with the Fulton County Conservation District and the Ozark Foothills Resource Conservation and Development (RC&D) area. This technology will then be used in the Illinois River area. The goal is for 80% of the landowners in the basin to receive this training.

The Arkansas Game and Fish Commission (AG&FC) in cooperation with the Arkansas Soil and Water Conservation Commission (ASWCC), will do a Tailwater Restoration and Habitat Improvement Project on the White River below Beaver dam. Technology used and developed here will be transferred to, and used in the Illinois River area to train conservation professionals and other interested persons in the effective use of streambank stabilization Best Management Practices.

Funding for the agriculture program is to come from agency operating budgets, ASCS special water quality funding, EPA 319(h) funds, and local sources. USDA's PL566 program is an alternate source of funding.

REFERENCES

1. Arkansas Soil and Water Conservation Commission, Quarterly Report to EPA, Federal Assistance Project # C9006706-91-1, November 1, 1994

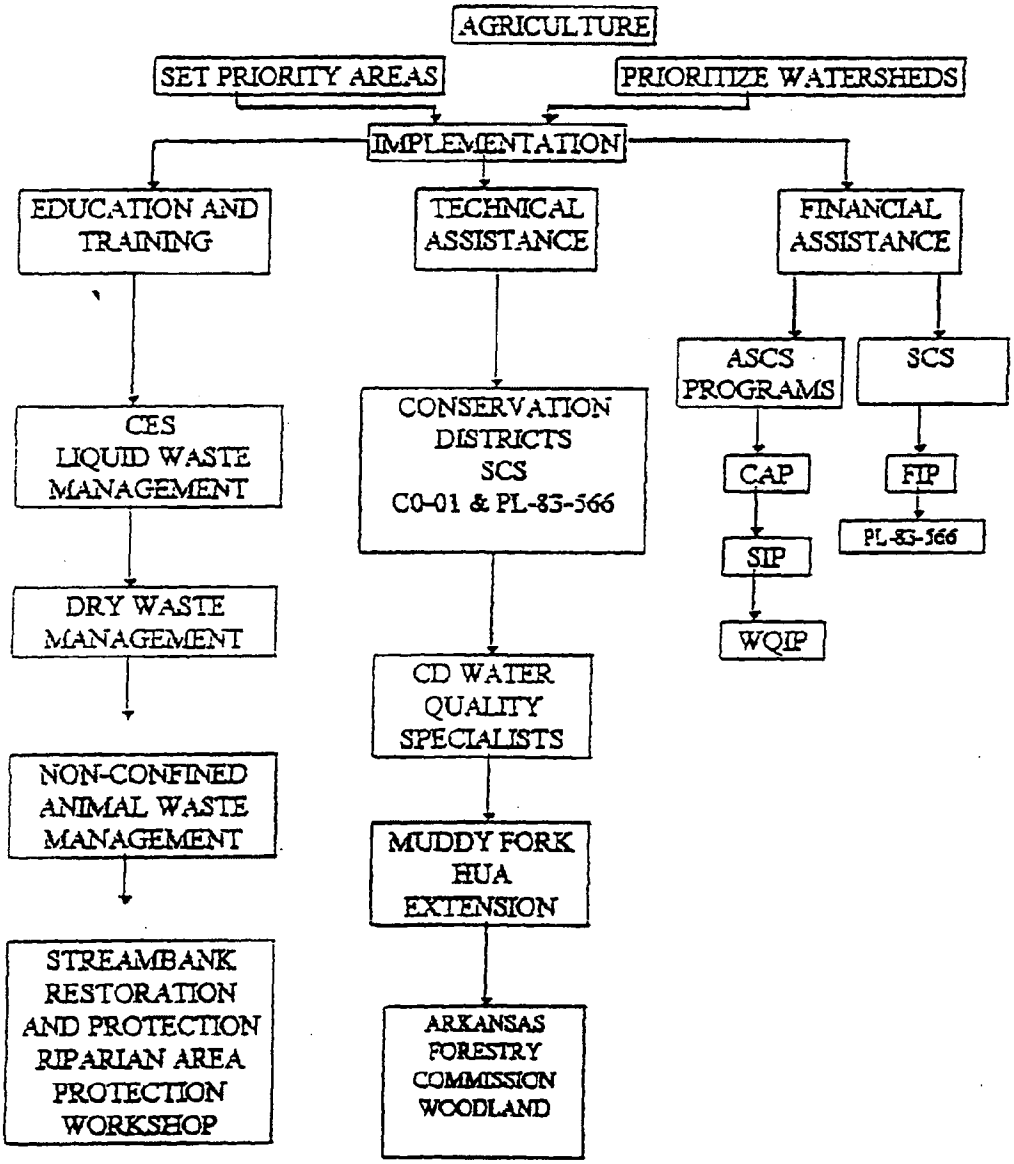
2. Edwards, Daniel, Murdoch, Vandrell and Nichols, "The Moores Creek Monitoring Project (Draft)", Arkansas Water Resource Center, Oct. 21, 1994.

3. Chauby, Edwards, Daniel and Nichols, "Effectiveness of vegetative Filter Strips in Controlling Losses of Surface-Applied Swine Manure Constituents," Transactions of the ASAE, Nov./Dec. 1993

4. Chauby, Edwards, Daniel, and Nichols, "Effectiveness of Vegetative Filter Strips in Controlling Losses of Surface-Applied Poultry Litter Constituents," Arkansas Water Resource Center, June, 1993

5. Soil Conservation Service, "Effects of Conservation Practices on Water Quantity and Quality", United States Department of Agriculture, Oct. 1988

Figure 7


AGRICULTURE
SET PRIORITY AREAS
PRIORITIZE WATERSHEDS
IMPLEMENTATION
EDUCATION AND TRAINING
TECHNICAL ASSISTANCE
FINANCIAL ASSISTANCE
CES LIQUID WASTE MANAGEMENT
DRY WASTE MANAGEMENT
NON-CONFINED ANIMAL WASTE MANAGEMENT
STREAMBANK RESTORATION AND PROTECTION RIPARIAN AREA PROTECTION WORKSHOP
CONSERVATION DISTRICTS SCS C0-01 & PL-83-566
CD WATER QUALITY SPECIALISTS
MUDDY FORK HUA EXTENSION
ARKANSAS FORESTRY COMMISSION WOODLAND
ASCS PROGRAMS
SCS
CAP
SIP
WQIP
FIP
PL-83-566

Silviculture:

There are approximately 166800 acres of woodland in the Illinois River Basin in Arkansas. About 30000 acres of this is national forest. The remainder is privately owned. The US Forest Service manages the federal land.

The U.S. Forest Service is committed to maintaining healthy ecosystems. Preventing nonpoint source pollution is an important part of maintaining ecosystem health. Properly managed forestland helps to keep the forest ecosystem healthy and to reduce nonpoint source pollution.

Forest Service management activities in the Illinois River Basin include: Timber harvest of less that 30 acres per year; management of approximately 2,000 acres in developed pasture through special use permits to private cattle producers; management of 450 acres in a small game management area and the Lake Wedington Recreation complex.

The Forest Service uses best management practices to prevent nonpoint source pollution. Logging is limited to periods when the soil is dry to prevent rutting and soil compaction. Rutting and soil compaction increase runoff which can cause accelerated erosion. Buffer strips are maintained along streams to absorb nutrients and to prevent sediment from entering streams. Logging roads and landings are designed to minimize soil movement and are closed and vegetated soon after timber has been harvested.

A thorough environmental analysis is done before any forest management activity to ensure that the beneficial and harmful affects of the activity are considered. Best management practices are included in the environmental analysis to mitigate any harmful effects. All activities are implemented and monitored to assure compliance with the environmental analysis. After project work is completed, areas are restored to a stable condition to maintain ecosystem health.

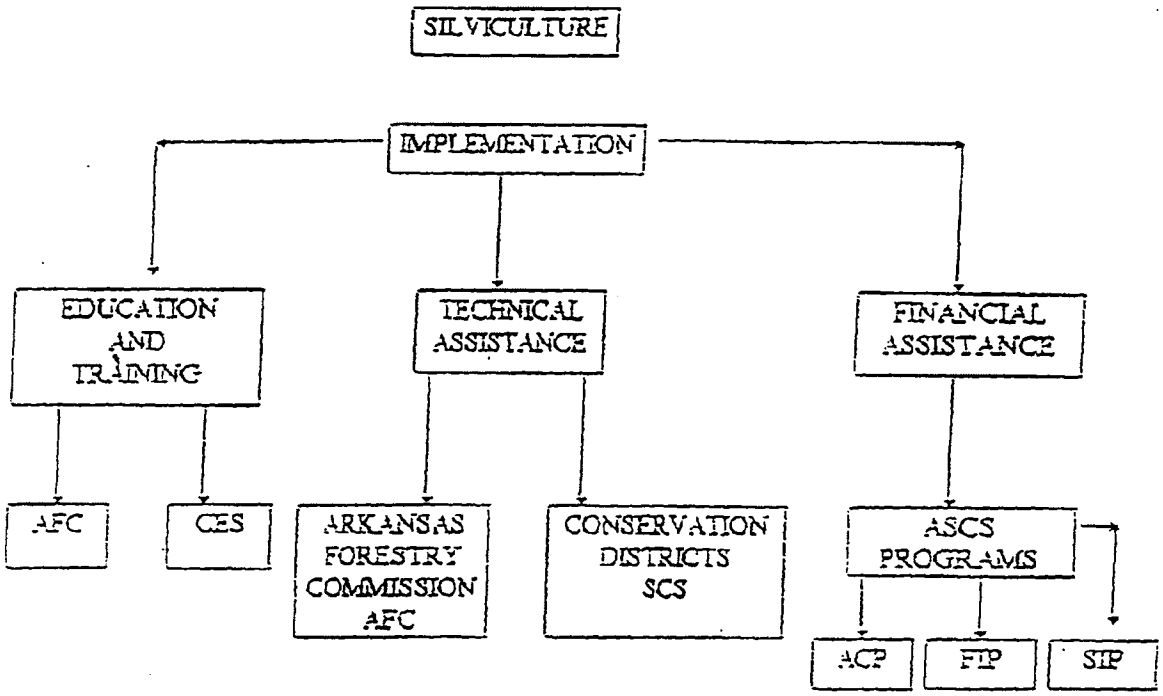
Good planning, management, and implementation significantly reduce the amount of nonpoint source pollution coming from national forest land.

The Arkansas Forestry Commission (AFC) has been designated as the lead state agency to administer the silvicultural portion of the states Water Quality Plan. AFC has made several specific site evaluations. A representative sample of these sites will be re-evaluated to determine any change in erosion rates.

AFC will give technical assistance to woodland owners in the basin to develop the woodland part of water quality management plans, and to effectively carry out Best Management Practices.

Landowners will also receive assistance from conservation districts through their regular conservation planning programs.

Figure 8


SILVICULTURE
IMPLEMENTATION
EDUCATION AND TRAINING
TECHNICAL ASSISTANCE
FINANCIAL ASSISTANCE
AFC
CES
ARKANSAS FORESTRY COMMISSION AFC
CONSERVATION DISTRICTS SCS
ASCS PROGRAMS
ACP
FIP
SIP

Roads:

Construction and maintenance of rural roads is the responsibility of the County Judge. Funding is through the county Quorum Court except in new developments where the developer is required to construct all roads, drainage facilities and utilities. Since rural roads are identified in this plan as a source of considerable sediment and phosphorus to the streams of the basin, it is recommended that rural roads be added to the State's Nonpoint Source Assessment Report as a secondary source of pollutants for watersheds in the basin. Adding rural roads to the Assessment, as well as updating the Arkansas ~~NPS~~ Pollution NPS Management Program, will make 319 (h) funds from EPA available to address problem areas.

Counties will receive technical assistance from the Natural Resource Conservation Service by becoming cooperators with their respective conservation districts. This assistance will help them plan and carry out a program for application of BMP's on their road systems.

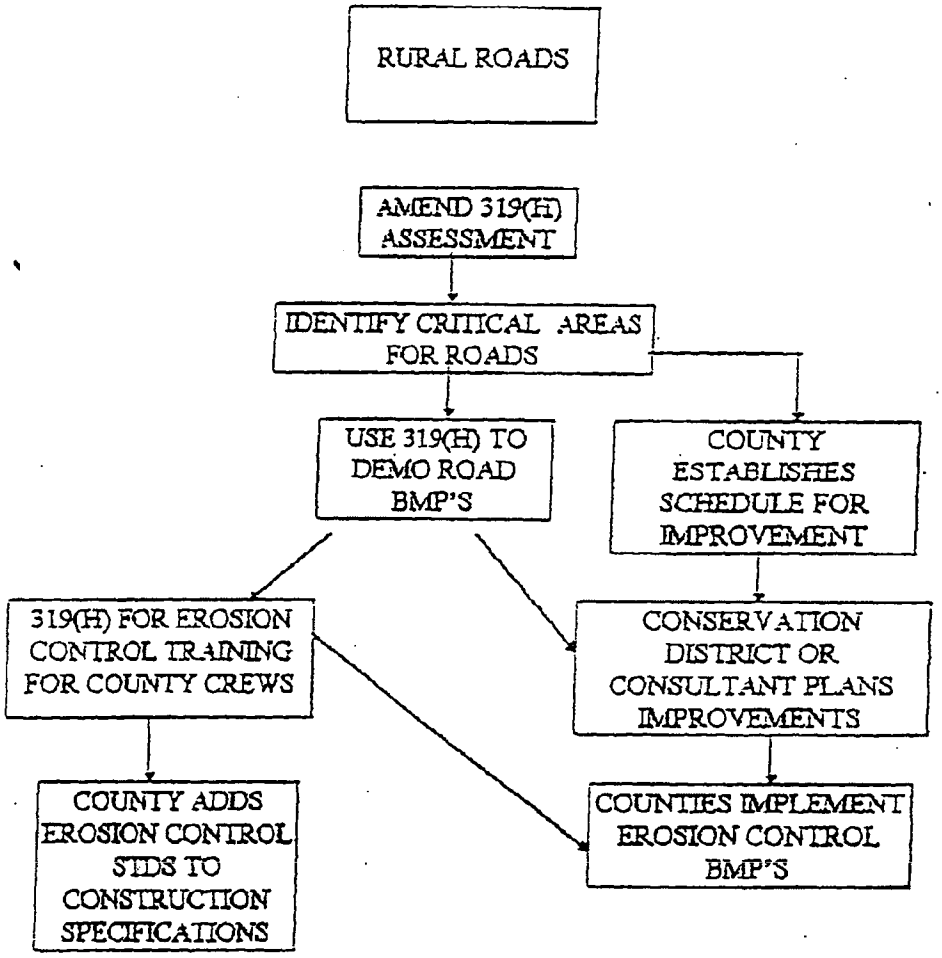
Counties should revise their standard specifications for road construction to require the use of erosion control BMPs on all new construction. The Arkansas State Highways and Transportation Department's Standard Specifications for Highway Construction, Section 110 Abatement of Water Pollution is an excellent example for these revisions.

Limited resources will be used most effectively if critical areas are treated for erosion control. Each county in the basin should survey their roads and develop a list of twenty to thirty critical areas.

The ASWCC with cooperation from the Counties will request 319(h) funds to conduct a demonstration of erosion control BMPs at one site in each county in the basin. The counties will then set a schedule for implementation of BMPs at the remaining critical sites depending on availability of funds. Planning for BMP implementation may be by the county road department or by local consulting engineers.

To facilitate planning and maintenance of rural road BMPs, the ASWCC will cooperate with the Arkansas highway Department and request 319(h) funds to conduct training programs for local consulting engineers and inspectors on construction BMPs and for county road crews on proper maintenance of rural road BMPs.

FIGURE 9


RURAL ROADS
AMEND 319(H) ASSESSMENT
IDENTIFY CRITICAL AREAS FOR ROADS
USE 319(H) TO DEMO ROAD BMP'S
COUNTY ESTABLISHES SCHEDULE FOR IMPROVEMENT
319(H) FOR EROSION CONTROL TRAINING FOR COUNTY CREWS
CONSERVATION DISTRICT OR CONSULTANT PLANS IMPROVEMENTS
COUNTY ADDS EROSION CONTROL STDS TO CONSTRUCTION SPECIFICATIONS
COUNTIES IMPLEMENT EROSION CONTROL BMP'S

Streambanks:

The ASWCC in cooperation with the AG&FC and the EPA is conducting a streambank restoration project on the White River in Carroll County in 1994 and 1995. Technology Transfer workshops will be conducted as a part of this effort. Illinois River basin Conservation District Water Quality Technicians and SCS personnel will be trained in vegetated streambank revetments in this project.

During the summer of 1994, the Arkansas Soil and Water Conservation Commission completed a survey of Streambanks along the main stem of the Illinois River. The results of this survey will identify critical areas for streambank restoration efforts. The ASWCC will notify the local Conservation Districts of the critical areas. It is recommended that the districts then work with the landowners to prepare a streambank stabilization plan and assist with implementation.

Potential sources of funding for streambank restoration work is the ACP, SIP, and PL-83-566 Programs.

FIGURE 10

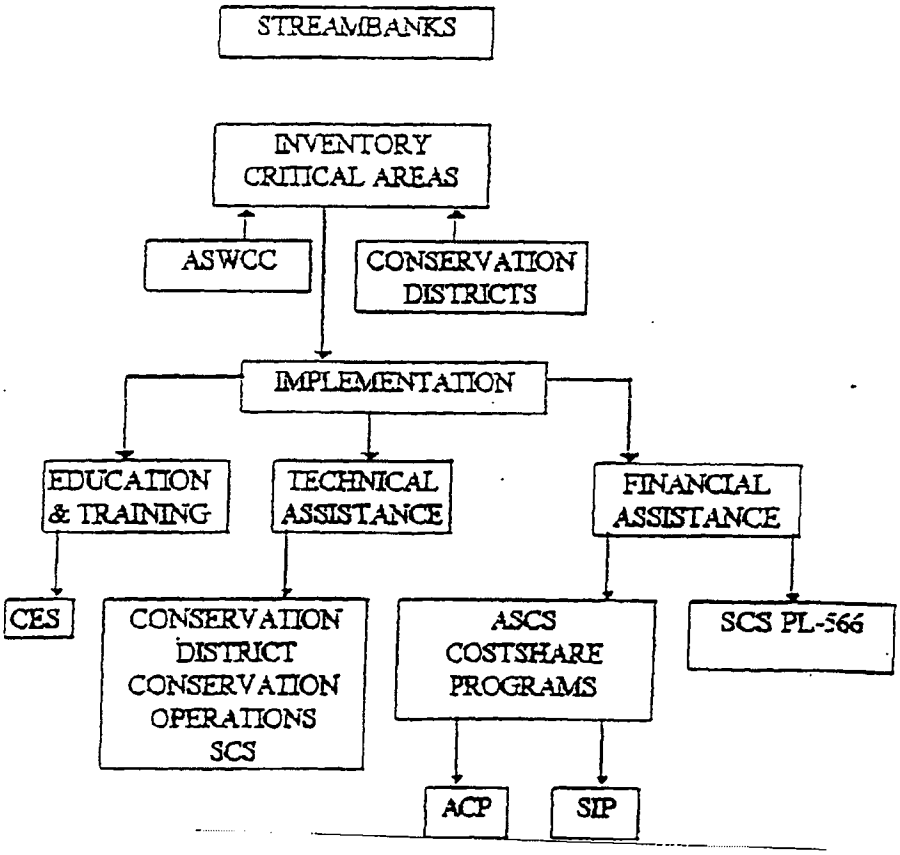
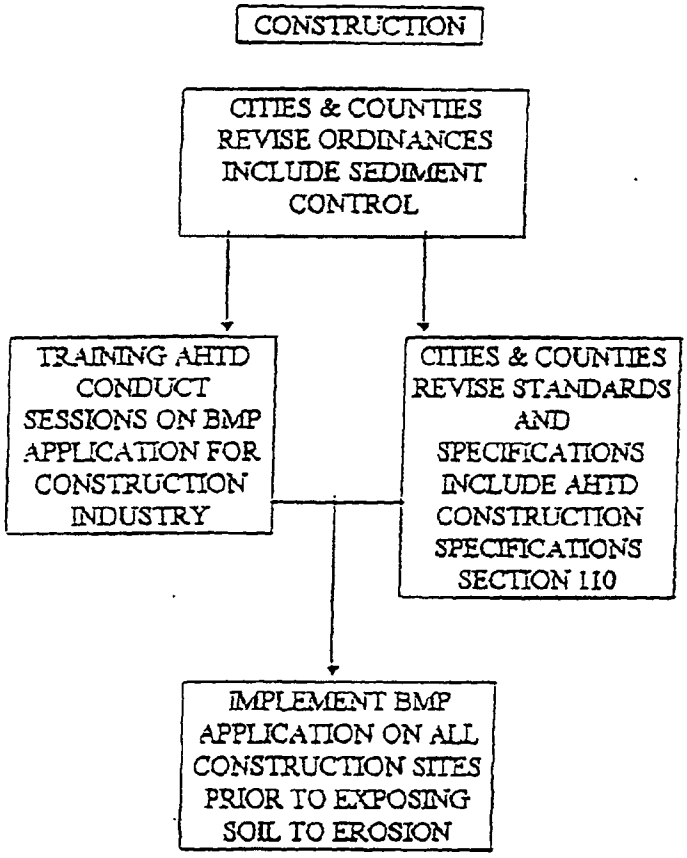


FIGURE 11


CONSTRUCTION
CITIES & COUNTIES REVISE ORDINANCES INCLUDE SEDIMENT CONTROL
TRAINING AHTD CONDUCT SESSIONS ON BMP APPLICATION FOR CONSTRUCTION INDUSTRY
CITIES & COUNTIES REVISE STANDARDS AND SPECIFICATIONS INCLUDE AHTD CONSTRUCTION SPECIFICATIONS SECTION 110
IMPLEMENT BMP APPLICATION ON ALL CONSTRUCTION SITES PRIOR TO EXPOSING SOIL TO EROSION

Construction:

A National Pollution Discharge Elimination System (NPDES)permit is required for any construction which disturbs 5 acres or more. An exception to this would be clearing for agricultural purposes. The Arkansas Department of Pollution Control and Ecology (ADPC&E) is responsible for the permits.

There are three main potential areas of construction in the Illinois River basin, highways, the proposed regional airport and general residential, commercial and industrial construction. The main concern with construction is erosion and sediment control. The Arkansas Department of Highways and Transportation's Standard Specifications for Highway Construction, Section 110 provides provisions for erosion and sediment control. These provisions are effective when properly implemented. The Airport Commission and the Municipalities in the basin should incorporate similar provisions into their standard specifications.

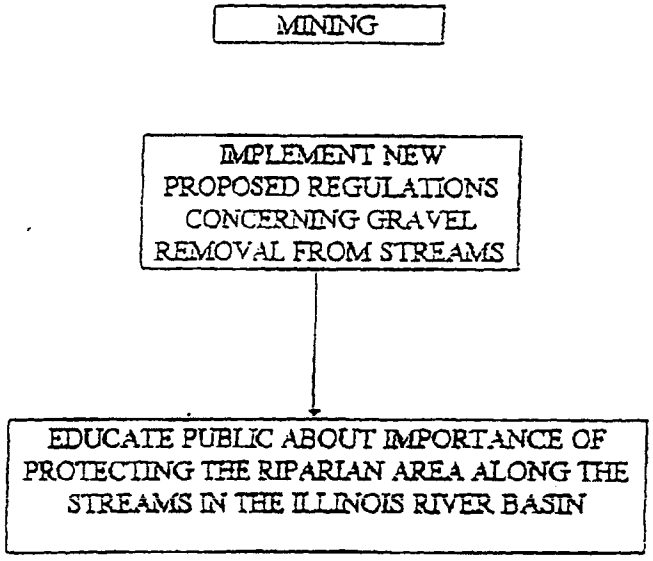
Cities and Counties in the basin should amend their drainage ordinances to require that all erosion and sediment control devices be in place and operable before construction is initiated.

A potential problem with implementation of construction BMPs is that Consulting Engineers and Construction Inspectors do not understand the details and importance of correct installation. To prevent this problem, it is recommended that the Arkansas Department of Highways and Transportation conduct periodic training courses for the construction industry on construction BMPs. Potential sources of funding for these courses are the EPA's Environmental Education Program or the EPA's Pollution Prevention Program.

Gravel Mining:

The Arkansas Department of Pollution Control and Ecology's Regulation 15 governs open pit gravel mining in Arkansas. The department has proposed changes to this regulation that will, among other things, prohibit removal of gravel from "Extraordinary Resource Waters" and set minimum standards for removal of alluvial materials (gravel) from other streambeds. The proposed revisions to regulation 15 incorporate the "Best Management Practices" for gravel mining. These revisions should be implemented and strictly enforced.

Figure 12



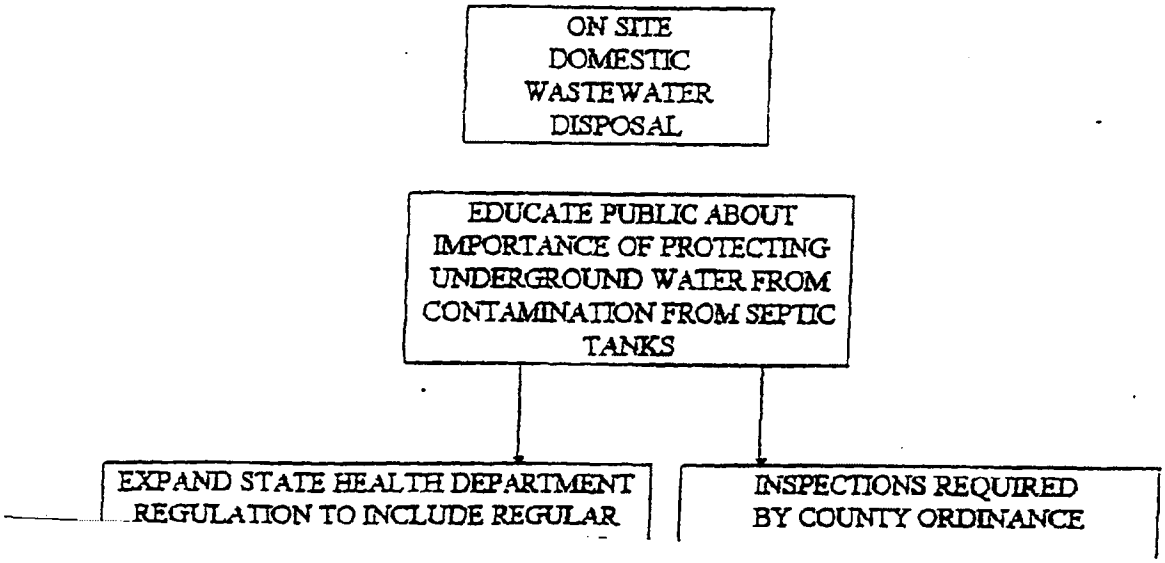
Onsite Domestic Wastewater Disposal:

The Arkansas Health Department's rules and regulations for septic tank installation are an effective tool to insure that onsite wastewater disposal is properly planned and installed. Under the current regulations, onsite wastewater disposal systems are designed by Designated Representatives (DRs) of the AHD and installed by licensed septic tank installers. DRs and installers both must have annual training to maintain their registration. The AHD should provide adequate staffing at the county level to assure that these rules and regulations are adequately enforced.

Ongoing operation and maintenance of septic tank or alternative systems is the responsibility of the home owner. This is perhaps the weak link in onsite wastewater disposal. One approach to assure proper operation and maintenance of septic tank systems would be for the AHD to make periodic inspections and require repairs when malfunctions are discovered. Enabling legislation and increased funding would likely be necessary before this approach could be implemented. An alternative would be for the county sanitarium or environmental officer to work with the banks and lending institutions and convince them to voluntarily require inspections of onsite waste disposal systems before they approve a real estate loan. The inspections could be done by a Designated Representative of the AHD for a consulting fee. Implementation of this alternative could assure that septic tanks are functional at the time property changes hands.

Electric companies could cooperate with counties to require inspection of wastewater disposal system before meter hookup is done.

FIGURE 13
ONSITE DOMESTIC WASTEWATER DISPOSAL



Urban:

Based on the information included in this report, it can be concluded that urban runoff is at least a secondary category of NPS pollution in Hydrologic Unit Areas 4002, 4003 and 4005. Therefore it is recommended that the state's Nonpoint Source Assessment Report be amended to include Urban runoff as a secondary category of pollution in these watersheds. This action will make section 319(h) funding available to the cities in those watersheds for implementation of nonpoint source management activities.

The available tools for managing urban nonpoint source are public awareness education. zoning ordinances. subdivision regulations and drainage ordinances. The cities. with the cooperation of state and federal agencies should utilize these tools for the implementation of urban Best Management Practices.

Education: The cities with the cooperation of the ASWCC should utilize 319(h) funds to implement demonstration projects on homeowner BMPs, residential development sediment control BMPs and commercial area sediment control BMPs. The public works departments within each city could then utilize slidesets or videos developed at each of the demonstrations to conduct programs at service clubs, youth groups and other organizations.

The school systems in all of the cities in the basin should incorporate ARWET into their curriculum. An agriculture representative should work with this program in a leadership role.

The cities should develop a series of public service announcements concerning management of urban nonpoint source. These PSA's would target homeowners and emphasize residential BMPs. The PSA's would air on local television and radio stations. The ASWCC could assist cities in development of the PSA's by making its video production lab available and providing technical assistance in development.

Zoning: Cities should modify their zoning ordinances to include the following:

- Maintenance of riparian buffer strips within the 100 year floodway as designated on the FEMA flood map.

- To minimize the volume of runoff from urban areas, the zoning ordinance should establish maximum percent impervious areas for each zone.

Subdivision Regulations: Subdivision regulations should be modified to include the following:

- All new construction should incorporate erosion control BMPs. An erosion control plan should be submitted with the subdivision or construction plan.

- Erosion control measures will be in effect prior to removing vegetation from the site.

- Stormwater detention facilities will be designed for sediment control as well as peak flow management.

- Vegetated filter strips are encouraged wherever stormwater is discharged from the site.

Drainage Ordinances: Drainage ordinances of cities in the basin are written primarily to manage the quantity of stormwater runoff. In many areas of the country, stormwater quality is also addressed in the drainage ordinance.

The cities should consider the stormwater utility concept as a method of funding stormwater management projects. Under this concept, a usage fee is charged for the stormwater system just as fees are charged for use of the water or sewer system. The fee is normally based on the lot size of the user or the calculated stormwater flow volume. This fee would be used to maintain the stormwater system in operable condition and to retrofit existing detention basins for sediment control. With a steady source of funding, the cities could then use the state revolving fund to finance high capital cost projects.

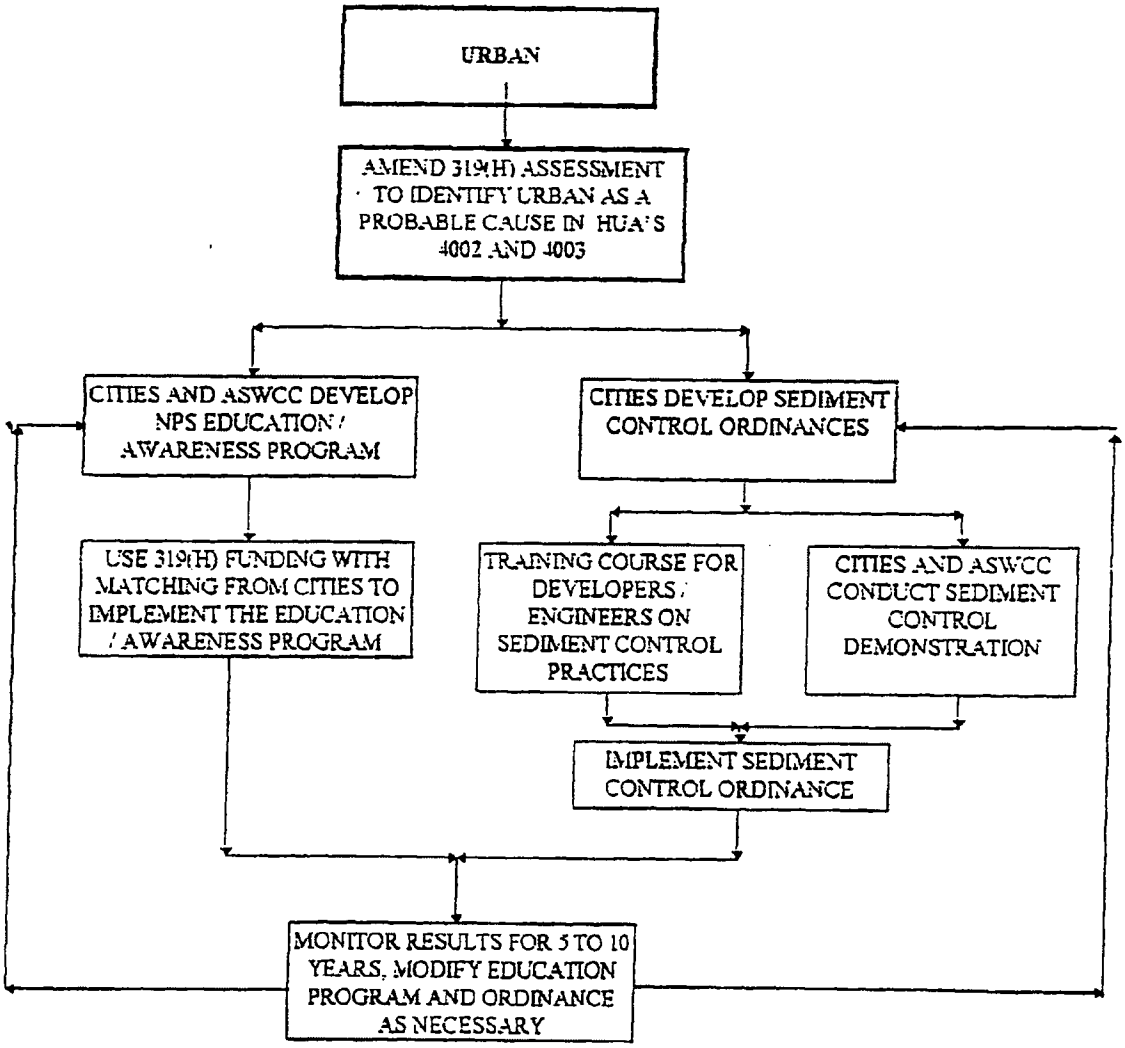
Public awareness is covered in a separate section.

Point Sources:

Point Source Management is conducted by the Arkansas Department of Pollution Control and Ecology through the National Pollution Discharge Elimination System. However, point sources do contribute to the overall nutrient loading of the Illinois River. All the city waste water treatment plants have nitrogen removal facilities. The Fayetteville plant is the only one with a phosphorus limit, at the present time. Voluntarily adding phosphorus removal to the other treatment plants would contribute significantly to reducing the nutrient load of the river.

In 1991, The General Assembly of the state of Arkansas passed legislation prohibiting the sale of phosphorus based detergents except for certain institutional uses. This legislation will help the cities reduce phosphorus discharge for the POTW"s. In the Chesapeake Bay Area a similar phosphorus ban resulted in a 16 to 21 percent decrease in total phosphorus discharged by POTW's

FIGURE 14


URBAN
AMEND 319(H) ASSESSMENT TO IDENTIFY URBAN AS A PROBABLE CAUSE IN HUA'S 4002 AND 4003
CITIES AND ASWCC DEVELOP NPS EDUCATION / AWARENESS PROGRAM
CITIES DEVELOP SEDIMENT CONTROL ORDINANCES
USE 319(H) FUNDING WITH MATCHING FROM CITIES TO IMPLEMENT THE EDUCATION / AWARENESS PROGRAM
TRAINING COURSE FOR DEVELOPERS / ENGINEERS ON SEDIMENT CONTROL PRACTICES
CITIES AND ASWCC CONDUCT SEDIMENT CONTROL DEMONSTRATION
IMPLEMENT SEDIMENT CONTROL ORDINANCE
MONITOR RESULTS FOR 5 TO 10 YEARS, MODIFY EDUCATION PROGRAM AND ORDINANCE AS NECESSARY

Public Awareness:

A general public apathy and lack of knowledge of the true conditions of the quality of the Illinois River in Arkansas was mentioned by several of the Focus Groups as a contributor to watershed management problems. To combat this lack of awareness, the Arkansas Soil and Water Conservation Commission in cooperation with the Arkansas Department of Pollution Control and Ecology and the Benton and Washington County Conservation Districts and the municipalities in the basin will conduct a public awareness program. The program will emphasize potential uses of streams in the basin, documented water quality problems, management measures that individuals or groups can take and who to contact for assistance. The public awareness program is divided into components for Children, Youth and Adult. The Adult program is further divided into Agriculture and Urban components. The following recommendations are made, pending availability of funding:

The children's program will be conducted in the Elementary Schools in the basin. Most of these schools already conduct some form of Environmental Education. Nonpoint Source Pollution can easily be incorporated into the curriculum. At the elementary level, the awareness program should be general rather than Illinois River specific. A number of good products have been developed for children for NPS awareness. The ASWCC will select appropriate materials consisting of videos, workbooks, posters etc. and distribute them to the schools in the basin. The ASWCC will also provide a suggested lesson plan with the materials. In addition, the local Conservation Districts will conduct an annual Nonpoint Source Pollution poster contest at the elementary schools.

The youth program will be run through the secondary schools in the basin. ARWET is a very effective public awareness tool for secondary school age youth. In this program, the school selects a stream site and conducts ongoing monitoring for a period of five years. The Arkansas Department of Pollution Control and Ecology will seek sponsors to conduct ARWET at each high school in the Illinois River basin with emphasis on an Illinois River basin monitoring site. The AACD has produced an outstanding video on nonpoint source pollution management titled "Clean Water, Clear Choices" that emphasizes agricultural Best Management Practices. The ASWCC will purchase copies of this video for each high school agriculture program in the basin and distribute the video to the instructors.

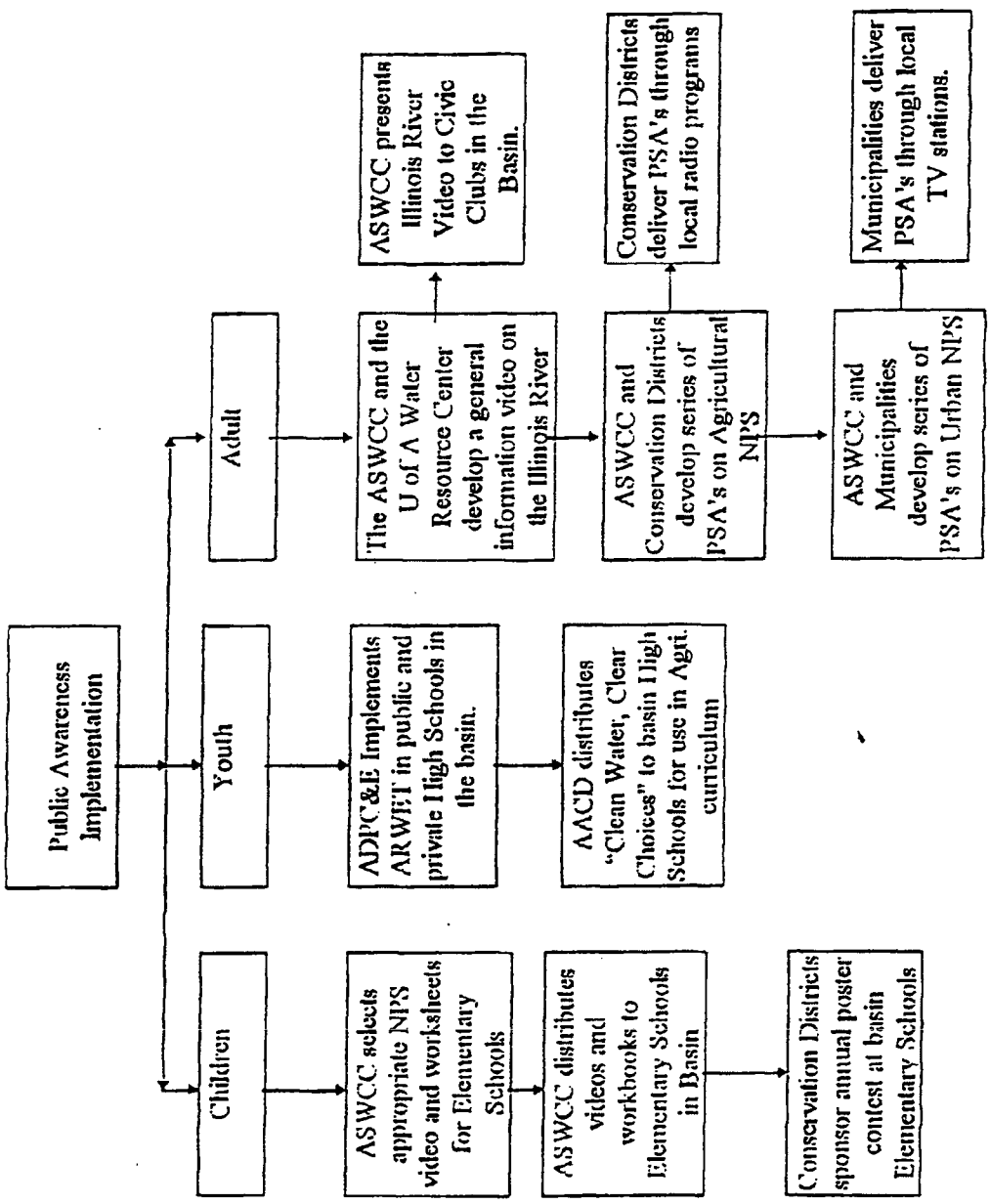
An informational video on water quality management or other appropriate informational material will be developed on the Illinois River. The objective of this video will be to make local business leaders and public officials aware of the water quality of the river and the details of this management plan. The ASWCC or other appropriate agency will present this video to local civic clubs and other interested parties.

The agricultural component of the public awareness program will be conducted by the local Conservation Districts. The districts will, in cooperation with the ASWCC develop a series of Public Service Announcements (PSA's) for local radio and television stations. Each PSA will identify a water quality problem, the resource management system to correct and/or prevent the problem, and the Conservation District as a source of technical assistance for planning and implementing the system.

The urban component of the public awareness program will be similar to the agriculture program except that the municipal governments will be the lead agency. The ASWCC will develop a series of PSA's dealing with urban NPS and provide them to the local governments. The local government will then seek to place the PSA's on local television stations. Each PSA will start with a statement on water quality in the Illinois River, give a potential source of Urban NPS effecting that water quality parameter and then describe the BMP for preventing that problem.

The ADPC&E should amend its 319(h) assessment for the basin to include public awareness as a potential source of water quality impairment. This action would make 319(h) funds available to the ASWCC and local agencies to implement those portions of the public awareness program if it is an integral part of an education program that target certain sources of NPS pollution. EPA Environmental Education funds could also be used to support this program.

Figure 15


Public Awareness Implementation
Adult
The ASWCC and the U of A Water Resource Center develop a general information video on the Illinois River
ASWCC presents Illinois River Video to Civic Clubs in the Basin.
ASWCC and Conservation Districts develop series of PSA's on Agricultural NPS
Conservation Districts deliver PSA's through local radio programs
ASWCC and Municipalities develop series of PSA's on Urban NPS
Municipalities deliver PSA's through local TV stations.
Youth
ADPC&E Implements AR WET in public and private High Schools in the basin.
AACD distributes "Clean Water, Clear Choices" to basin High Schools for use in Agri. curriculum
Children
ASWCC selects appropriate NPS video and worksheets for Elementary Schools
ASWCC distributes videos and workbooks to Elementary Schools in Basin
Conservation Districts sponsor annual poster contest at basin Elementary Schools

Interstate Coordination:

The Arkansas - Oklahoma Arkansas River Compact was formed in 1972 with the major purposes of promotion of interstate unity, providing for equitable apportionment of the waters of the Arkansas River, providing an agency for administering the water apportionment, encouragement of an active pollution abatement programmed in each state and facilitation of the cooperation of the water administration agencies in the total development and management of the water resources of the Arkansas River Basin. In order to carry out these purposes, the Governors of the states have appointed representatives to the Arkansas River Compact Commission. The following are the names and addresses of the Arkansas River Compact Commission.

J. Randy Young, P.E.
Ark. Soil & Water Cons. Comm.
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Little Rock, AR 72201

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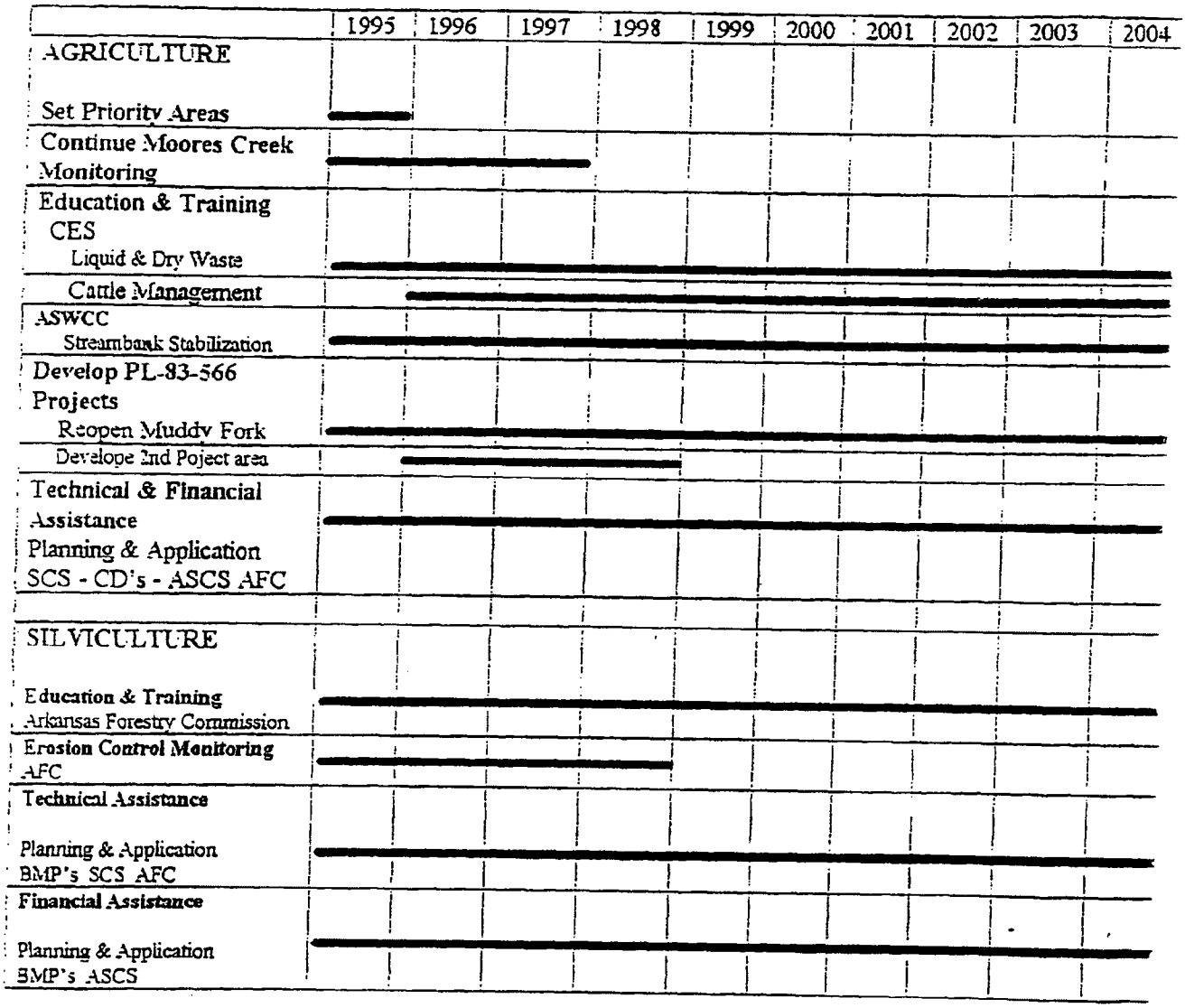
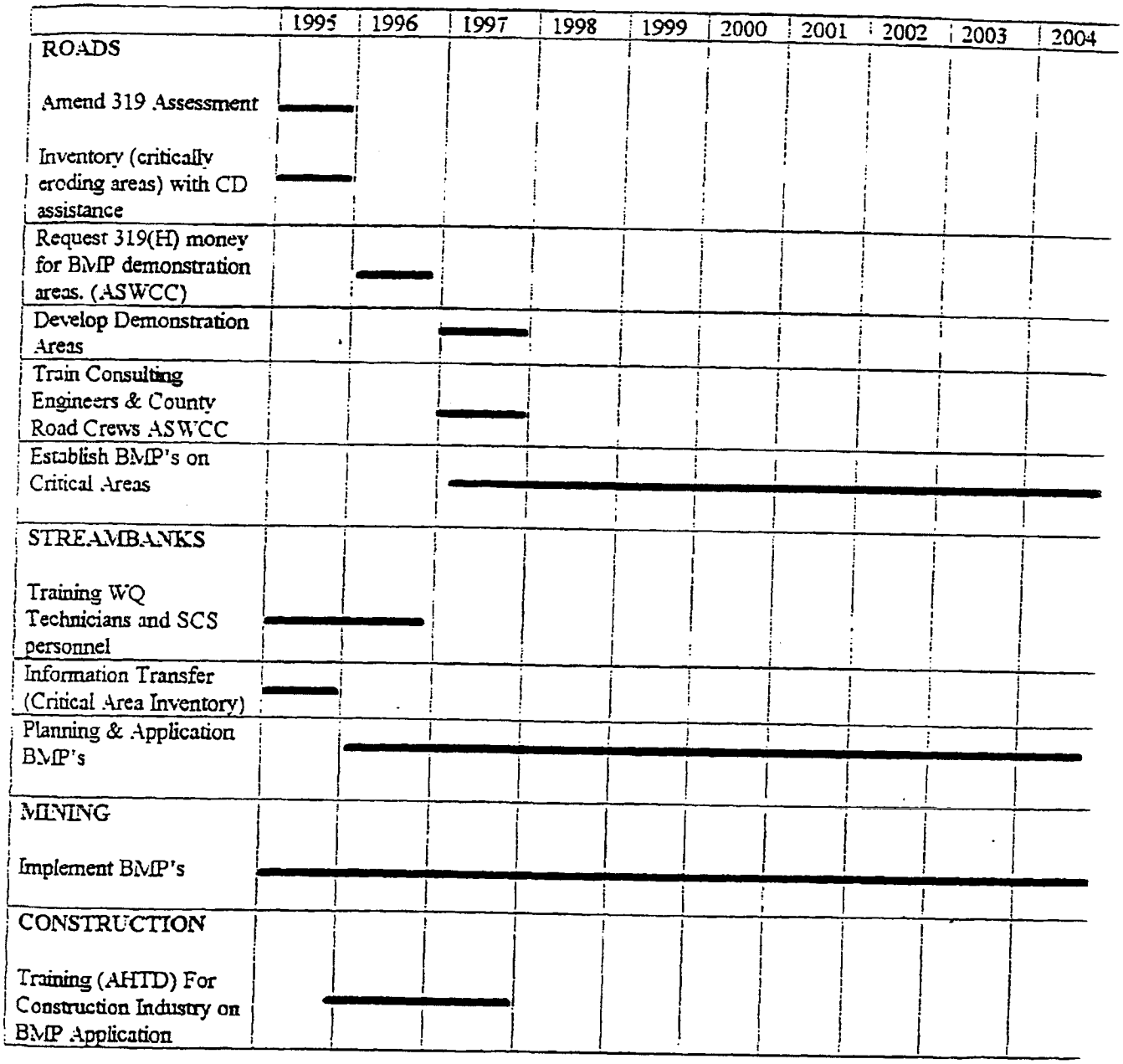
The Environmental and Natural Resources Committee of the Compact Commission can be extremely useful in assisting in development of a management plan for the Illinois River. The committee in their annual report to the Compact can bring recommendations for the adoption and implementation of a management plan. This offers an excellent method to secure concurrence of the management plan by an interstate compact.

REFERENCE:

1. Effectiveness of Vegetated Filter Strips In Retaining Surface Applied Swine Manure Constituents. By L Chauhey, D.R. Edwards, T.C. Daniel, P.A. Moore, Jr., and D. J. Nichols. Department of Agronomy, University of Arkansas, Fayetteville, AR.

IMPLEMENTATION SCHEDULE

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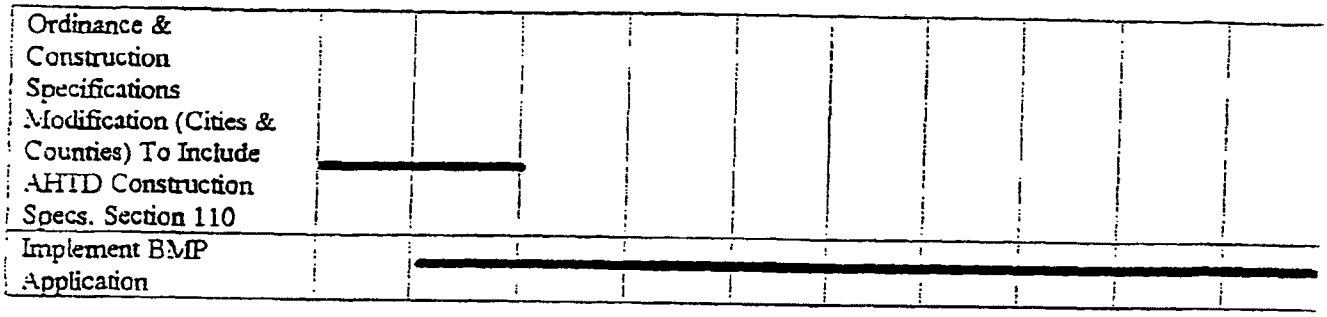
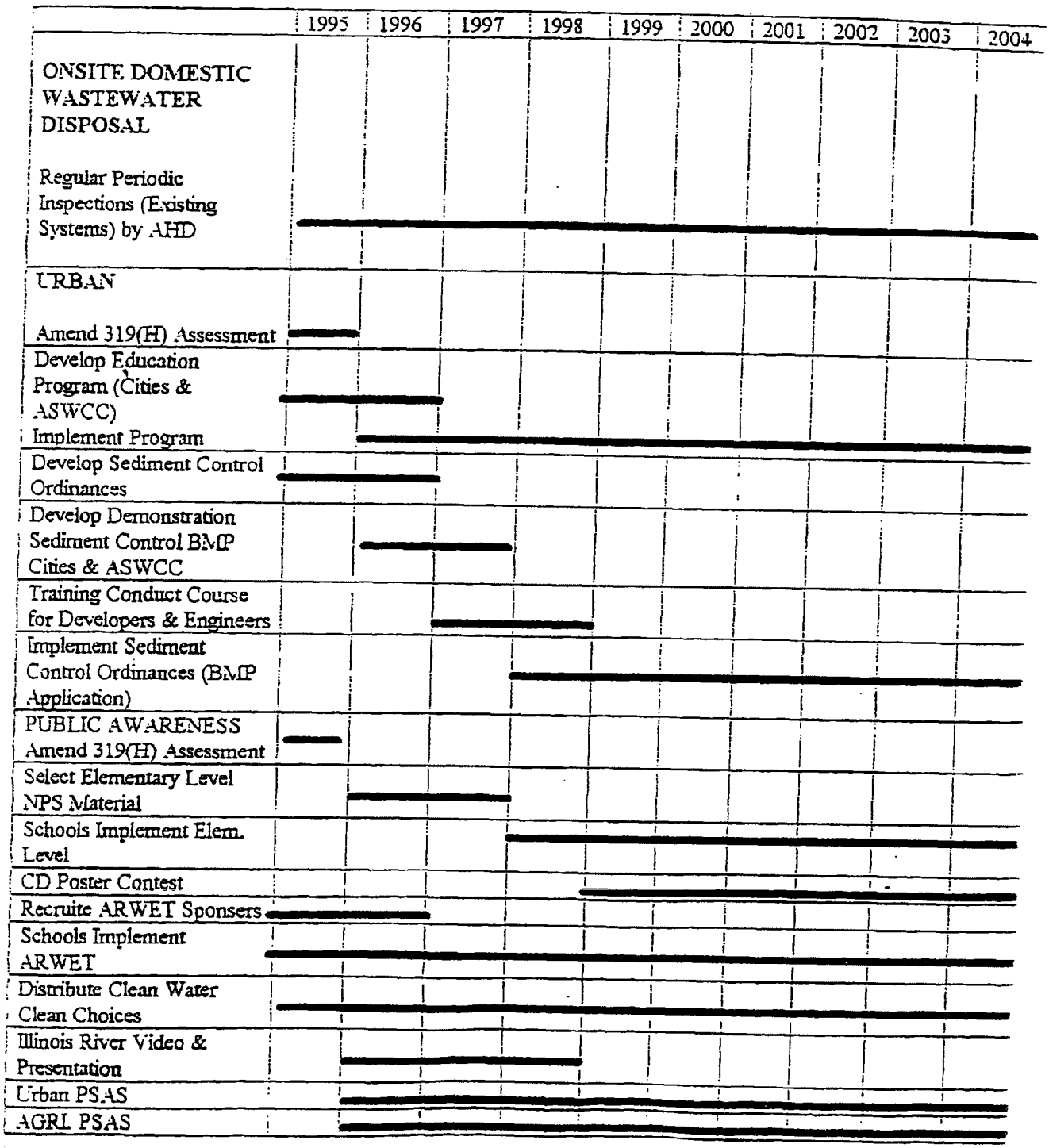
ROADS
Amend 319 Assessment
Inventory (critically eroding areas) with CD assistance
Request 319(H) money for BMP demonstration areas. (ASWCC)
Develop Demonstration Areas
Train Consulting Engineers & County Road Crews ASWCC
Establish BMP's on Critical Areas
STREAMBANKS
Training WQ Technicians and SCS personnel
Information Transfer (Critical Area Inventory)
Planning & Application BMP's
MINING
Implement BMP's
CONSTRUCTION
Training (AHTD) For Construction Industry on BMP Application


Ordinance & Construction Specifications Modification (Cities & Counties) To Include AHTD Construction Specs. Section 110
Implement BMP Application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ONSITE DOMESTIC WASTEWATER DISPOSAL
Regular Periodic Inspections (Existing Systems) by AHD
URBAN
Amend 319(H) Assessment
Develop Education Program (Cities & ASWCC)
Implement Program
Develop Sediment Control Ordinances
Develop Demonstration Sediment Control BMP Cities & ASWCC
Training Conduct Course for Developers & Engineers
Implement Sediment Control Ordinances (BMP Application)
PUBLIC AWARENESS
Amend 319(H) Assessment
Select Elementary Level NPS Material
Schools Implement Elem. Level
CD Poster Contest
Recruite ARWET Sponsers
Schools Implement ARWET
Distribute Clean Water Clean Choices
Illinois River Video & Presentation
Urban PSAS
AGRL PSAS